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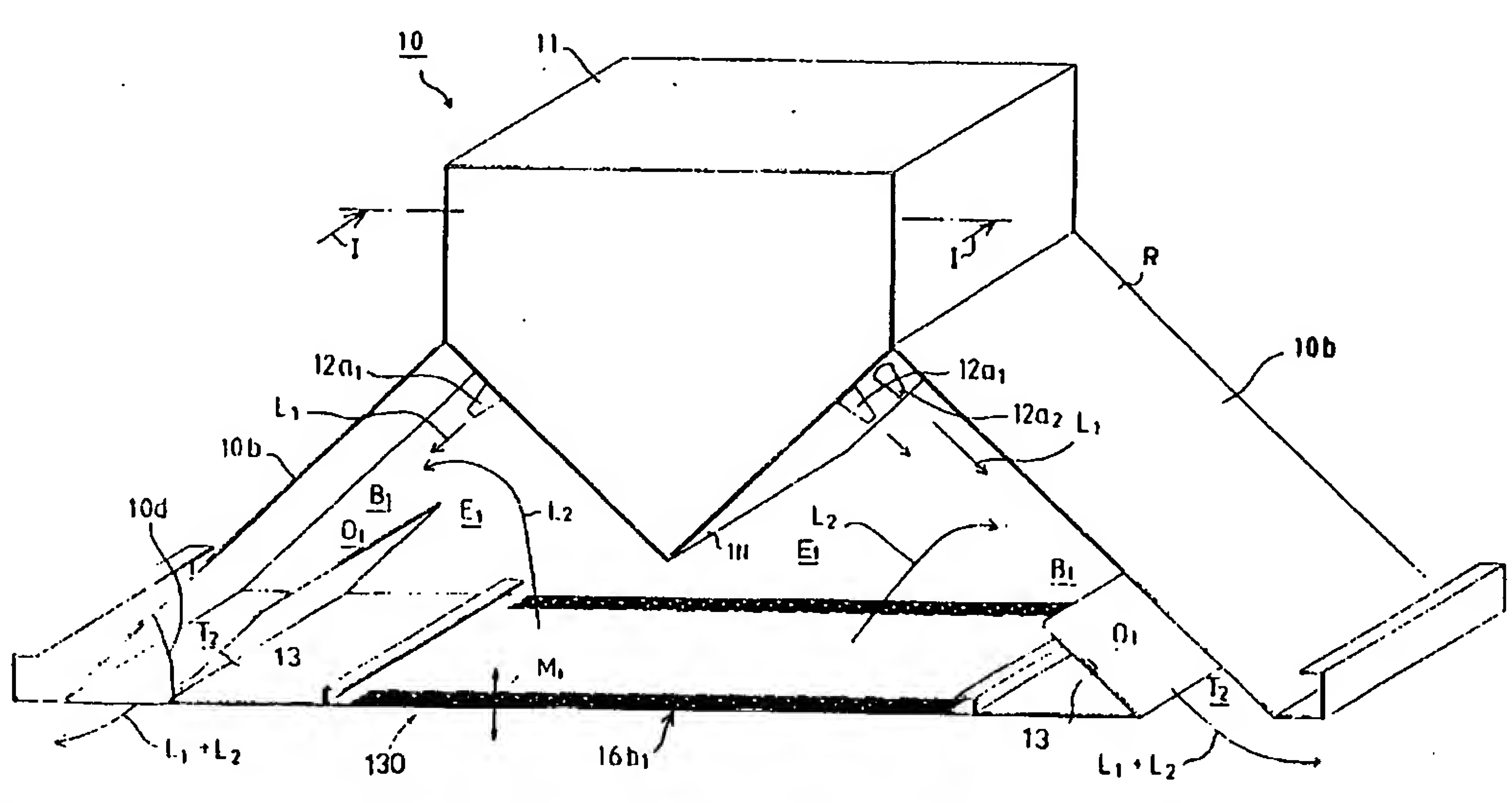

(57) **Abstract:** The invention concerns a supply air terminal device (10). The supply air terminal device includes a supply air chamber (11) and therein several nozzles ($12a$, $12a_2$, ...; $12b_1$, $12b_2$, ...) or a nozzle gap, through which a supply airflow (L_1) is conducted into a mixing chamber (B_1) inside the device. The supply air terminal device includes a flow aperture (T_1) on one side of the device, through which a circulated airflow (L_2) is conducted from the room, whereby the said circulated airflow is conducted to join the supply airflow (L_1) induced by the supply airflow (L_1). The flows combine in the mixing chamber (B_1) inside the device, and the combined airflow ($L_1 + L_2$) of the supply airflow (L_1) and the circulated airflow (L_2) is made to flow further out of the device.

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Supply air terminal device

The invention concerns a supply air terminal device.

Induction of room air into the supply air before the room space has been applied even earlier in various applications. Traditionally, the air is circulated by an air-conditioning unit. The said circulation of air through an air-conditioning unit causes a loss of energy, adds to the migration of impurities from one room to another and adds to their accumulation in the duct system.

This application presents a supply air terminal device of a new type, wherein the circulated air is mixed in an internal mixing chamber with the fresh supply air without heating or cooling the circulated air.

Internal circulation of air in the device is a way of avoiding expensive re-circulated air solutions through the supply air terminal unit and at the same time of preventing impurities from spreading from one room space to another.

The device is characterised in that

- The primary air is blown into the device through nozzles.
- The secondary room air is taken into the device by way of controlled flow routes.
- The flow of secondary air is brought about by using the induction effect of the primary air.
- The primary air and the secondary air are mixed within the device before the air discharges from the device into the room space.
- The ratio of secondary air can be controlled by using an internal control part in the supply air terminal device either manually or using an electric
- motor. Motor control is controlled with the aid of a separate control device or control algorithm.

- The device may also function as a condensing device, whereby it is equipped with a condensate removal fitting.

When the device includes an induction ratio control device, the device can be used for controlling the room air velocity and thus for controlling comfort conditions irrespective of the flow of supply air.

The supply air terminal device is characterised in that its supply air jet behaves almost like an isothermal jet, whereby in a cooling situation it is possible to prevent the supply air jet from dropping directly into the occupied zone and thus significantly to avoid the risk of draught, and in a heating situation it is possible to avoid un unfavourable temperature stratification in the ceiling. The behaviour of the inducing supply air terminal device also guarantees an efficient mixing of room air and a high efficiency of ventilation. Owing to its characteristics, the inducing supply air terminal device is especially suitable for such service situations, where the primary air used as supply air is significantly cooler or warmer than the room air. The supply air temperature may vary significantly in different service situations of the installation, or the air volume of supply air, that is, of the primary airflow, may change during service. The supply air terminal device according to the invention, which strongly induces the circulated air, may be used e.g. in the following cases:

- in cases where unheated supply air is used as the primary air,
- in air heating systems,
- in installations, where cold storages are used to level out electric energy consumption peaks round the clock,
- in variable air volume systems to guarantee that the shape of the air jet remains unchanged irrespective of the primary air volume,
- in standard air volume systems to control comfort conditions by controlling the induction ratio.

According to the invention, a new type of supply air terminal device is de-

signed, wherein the equipment includes a supply air chamber, from which the supply air is made to flow through a nozzle or preferably through several nozzles at a high velocity into an internal mixing chamber of the device, whereby the said flow of supply air will induce a circulated airflow from the room to flow to join the flow of supply air in the mixing chamber. The circulated airflow is thus drawn with the aid of the supply airflow into the mixing chamber, and the combined airflow will leave the device. The combined airflow moves freely into the room space through a flow gap extending over the length of the device or through a round or annular flow aperture without any perforated surface or such that would slow down the airflow. The device is thus efficient and it can be used to circulate great air volumes of room air. The circulated airflow is neither heated nor cooled by a heat exchanger, but the circulated airflow arrives from the room space to join the primary airflow directly. In the device solution according to the invention, the air is conducted from the room space induced by the supply airflow L_1 to join this, and the combined airflow $L_1 + L_2$ is conducted from the mixing chamber through an elongated flow gap or aperture into the room space. Under these circumstances, there are no perforated plate structures or such slowing down the flow velocity of the airflow on the discharge side of the mixing chamber. However, it is possible to use guiding parts guiding the flow or changing the shape of the flow jet.

In this application, the airflow conducted from the supply air chamber through a nozzle or preferably through nozzles is called the primary airflow, that is, the supply airflow, while the airflow induced by the primary airflow and conducted from the room space is called the circulated airflow, that is, the secondary airflow, in this application.

In a supply air terminal device, wherein the supply air is supplied through a supply air chamber and wherein the room air is circulated with the aid of a device, control of the induction ratio has also become necessary in certain

applications. This means that it is possible to control the ratio Q_2/Q_1 between the flow volumes Q_2 and Q_1 of the circulated airflow L_2 and the supply airflow L_1.

For implementation of the above-mentioned control, the present application proposes use of a separate induction ratio control device. In one advantageous embodiment, the induction ratio control device is formed by a structure, where the flow of circulated air from the room space is controlled by controlling the position of apertures in a movable aperture plate, which is located in connection with a fixed aperture plate, in relation to the apertures in an aperture plate located in a fixed position. Under these circumstances, the flow of circulated air can be throttled into the circulated airflow device on the supply side, and in this manner the induction ratio between flows L_2 and L_1 is controlled. Control may also take place by controlling the combined airflow $L_1 + L_2$ of supply airflow and circulated airflow. The more the airflow $L_1 + L_2$ is throttled, the lower the induction ratio will be, that is, the air volume of the circulated airflow L_2 becomes smaller in relation to the primary airflow L_1. According to the invention, the control device may also be located on the supply side of side chamber B_1, whereby e.g. by a plate movable in a linear direction the flow path of the circulated airflow L_2 is controlled, and at the same time the concerned flow L_2 of circulated air is controlled and the induction distance is affected. The control plate may be located in the direction of the other duct wall of mixing chamber B_1 and it may be movable in its direction, e.g. by remote control by a motor or manually.

Besides the above-mentioned ways of controlling the induction ratio, such a control device may also be used, which is formed by a set of nozzles formed by nozzles in two separate rows opening from the supply chamber for fresh air, whereby the nozzles in the first row are formed with a larger cross-sectional flow area than the nozzles in the second row. In connection with the

said nozzles a control device is located, which is formed by an aperture plate used for controlling the flow between the nozzle rows of the said nozzles.

The supply air terminal device according to the invention is characterised by the features presented in the claims.

In the following, the invention will be described by referring to some advantageous embodiments of the invention shown in the figures of the appended drawings, but the intention is not to limit the invention to these embodiments only.

Figure 1A is an axonometric view of a supply air terminal device according to the invention, which is open at the bottom and closed at the top and on the sides.

Figure 1B is a cross-sectional view along line I–I of Figure 1A.

Figure 1C shows a supply air terminal device equipped with an induction ratio control device.

Figure 1D is a cross-sectional view along line II–II of Figure 1C.

Figure 1E is an axonometric separate view of the structure of the induction ratio control device.

Figure 2 shows an embodiment of the induction ratio control device according to the invention, wherein the control device is located in side chamber B_1.

Figure 3A shows a third advantageous embodiment of an induction ratio control device, wherein the control device is fitted to be located on one side wall

of side chamber B_1, that is, in the air guiding part, to close and open the flow path into the side chamber B_1.

Figure 3B is an axonometric view of a moving mechanism for the control damper of a control device according to Figure 3A.

Figure 3C shows an embodiment of the invention, wherein there is a separate turning control damper, which can be used for controlling the induction ratio between the flows L_2 and L_1. The damper is fitted to turn in a pivot point, which is located on a side surface of the supply air chamber.

Figure 3D shows a device according to the invention, wherein nozzles opening from the supply air chamber direct the supply airflow on to the ceiling of the room space, whereby due to the coanda effect the flow will cling to the ceiling and the supply air flow will draw the circulated airflow along with it centrally from the room.

Figure 4A shows an embodiment of the induction ratio control device, wherein the device includes two nozzle rows $12a_1, 12a_2$ ... and $12b_1, 12b_2$ ... for the primary air flow L_1 whereby from between the nozzles of the nozzle rows the flow ratio is controlled with the aid of a control plate located in the supply chamber for the primary airflow, which control plate includes flow apertures f_1, f_2 ... for the nozzles of one nozzle row $12a_1, 12a_2$ ... and flow apertures t_1, t_2 ... for the nozzles $12b_1, 12b_2$ ... of the other nozzle row.

Figure 4B shows the area X_1 of Figure 4A.

Figure 5 shows an embodiment of the induction ratio control device, wherein the supply chamber for the primary airflow on both sides of vertical central axis Y_1 in the supply air chamber includes two nozzle rows, whereby the nozzles in the nozzle rows have different cross-sectional flow areas, and the

airflow to the nozzles is controlled by an internal tube having flow apertures by rotating the tube, whereby depending on the angle of rotation of the tube, the flow is controlled through nozzles of the different nozzle rows, and in this manner the flow velocity of flow L_1 in the mixing chamber is controlled and thus the induction ratio between flows L_1 and L_2 is controlled.

Figure 6A shows an embodiment of the invention, wherein the circulated airflow is conducted from above into the mixing chamber to join the supply airflow L_1, and the combined airflow is made to flow through the lower flow gap of the mixing chamber into the room space.

Figure 6B shows the device solution of Figure 6A equipped with the induction ratio control device.

Figure 7A shows an embodiment, wherein the circulated airflow is conducted from the side of the device into the mixing chamber to join the supply airflow.

Figure 7B shows the device solution of Figure 7A equipped with the induction ratio control device.

Figure 8A shows an embodiment of the invention, wherein the supply airflow is directed from the nozzles directly downwards from the supply air chamber towards the central flow aperture T_2, while the circulated airflow is directed from above into the side chamber and further from the side to join the supply airflow, whereby the combined airflow is made to flow downwards in the device.

Figure 8B shows the device solution of Figure 8A equipped with the induction ratio control device.

Figure 9A shows a model closed at the top and on the sides, wherein each side chamber B_1 is limited by a separating wall and a side wall and wherein the circulated airflow is directed from below to join the supply airflow to the central part of the device into the space between the separating walls, and the combined airflow is conducted further downwards and out of the device.

Figure 9B shows the device solution of Figure 9A equipped with the induction ratio control device.

Figures 10A–10J show how the embodiments of supply air terminal devices presented above are located in the room space. The figures are vertical cross-sections of the room space and they show different throw patterns of the supply air jet $L_1 + L_2$ with different positions and variations of the devices.

Some advantageous embodiment of the invention will be described hereinafter. The invention includes a supply air chamber for the supply air, from which the fresh supply air is distributed through nozzles into an internal mixing chamber of the device, into which the circulated airflow is also conducted from the room space induced by the mentioned supply airflow. In the most advantageous embodiment of the invention, the supply air chamber includes several nozzles located side by side and preferably fitted to form one or more nozzle rows. Such an embodiment is also possible within the scope of the invention, wherein the nozzles are replaced by one or more elongated nozzle gaps.

Figure 1A is an axonometric view of the supply air terminal device 10. Figure 1A shows a model, which is closed at the top and on the sides and wherein the internal mixing chamber/chambers B_1 of the device are limited by side plates 10b and end plates 10d, of which one end wall 10d is cut open in part in Figure 1A to show the internal structures. In addition, from above the mixing chamber/mixing chambers B_1 are limited by the bottom wall 111 of the supply

air chamber 11. Thus, the structure shown in Figure 1A opens only at the bottom into room space H as shown in the figure. Fresh air is conducted by way of the supply duct into supply chamber 11, from which the air is conducted further through nozzles $12a_1$,$12a_2$ ... into side or mixing chambers B_1 of the device on both sides of the vertical central axis Y1 of the device. The figure shows nozzles $12a_1$,$12a_2$ ... of the supply air chamber 11, through which the air is conducted into the side chambers B_1. This is the most advantageous embodiment of the invention. Within the scope of the invention such an embodiment is also possible, wherein the several nozzles $12a_1$,$12a_2$ ... are replaced by a flow gap. In this application, supply air means that supply air, which is conducted from supply air chamber 11 through the nozzles into mixing chamber B_1 and which induces the circulated airflow L_2 from room H into mixing chamber B_1. The supply airflow is also called the primary airflow. The circulated airflow L_2 induced by the supply airflow L_1 is also called the secondary airflow. As is shown in Figure 1A, the supply air terminal device 10 includes in between the air guiding parts 13 limiting side chambers B_1 in the central area of the device and below supply air chamber 11 a free flow path E1 for the circulated airflow L_2. For the circulated airflow $L_2$of the room there is a free flow path E_1 into side chambers B_1 from the central part of the device. The said air flow L_2, that is, the secondary airflow, is brought about by the primary airflow L_1 from nozzles $12a_1$,$12a_2$ ... of supply chamber 11. In the side chambers B_1 the airflows L_1,L_2 are combined, and the combined airflow $L_1 + L_2$ is made to flow to the side guided by the air guiding parts 13 located in the lower part of frame R and by the side plates 10b of the supply air terminal device 10. Flow $L_1 + L_2$ arrives through a gap or aperture T_2 in the room space in such a way that its velocity will not slow down essentially. The supply air terminal device includes no heat exchanger for heating or cooling the circulated airflow L_2.

The device shown in the figure may include such an arrangement as the induction ratio control device 15, wherein an assembly 130, which includes air

guiding parts 13 and a connecting structure between them, including flow apertures $16b_1$ or such for the circulated airflow L_3, can be moved as one structural component towards the supply air chamber 11 and away from it as shown by arrow M_1. By this move the induction ratio Q_2/Q_1 between the flows L_2 and L_1 is controlled. In the figure, reference number 130 indicates the movable assembly.

Figure 1B is a cross-sectional view along line I–I of Figure 1A of a first advantageous embodiment of the invention. Figure 1B is suitable also as a cross-sectional view for such device solutions, wherein the supply air terminal device has a square cross section or a circular cross section. Supply air terminal device 10 includes a supply air chamber 11 for the fresh supply air, from which the air is conducted through nozzles $12a_1, 12a_2$ ... into the side or mixing chamber B_1 of the device and further into room space H. In the embodiment shown in the figure, the supply air terminal device is a structure closed on the sides and at the top. With the aid of supply airflow L_1, circulated air L_2 is induced from below the device into side chamber B_1. The combined airflow $L_1 + L_2$ is made to flow away from the side chamber and to the side from the device, preferably at the level of the roof of the building, such as at ceiling level. Hereby the device will be located in such a way in relation to the ceiling level, that the bottom parts of the device frame are located at ceiling level, to which the combined airflow $L_1 + L_2$ is directed. Supply air terminal device 10 includes a free flow path E_1 for the circulated airflow L_2 into side air chamber B_1 from below the supply air chamber 11 and centrally in such a way that the circulated airflow L_2 can be directed to both sides of the central axis Y_1 of the device. The supply air terminal device 10 includes in the supply air chamber a flow gap or, according to the most advantageous embodiment, several nozzles $12a_1, 12a_2$ ... side by side, from which the conducted fresh supply air will induce the circulated airflow L_2 to flow centrally in the device through the free flow path E_1 below supply air chamber 11 into side chamber B_1. In side cham-

ber B_1, flows $L_1 + L_2$ are combined, and the combined airflow $L_1 + L_2$ is conducted to the side from the device in the direction of the ceiling level.

As is shown in the figure, supply air chamber 11 closes device 10 at the top. The side plates 10b and end plates 10d of the device frame R close the device on the sides. The device has a flow path O_1 for the combined airflow $L_1 + L_2$ between air guiding part 13 and side wall 10b away from side chamber B_1 and further in the direction of the ceiling level into the room space. The side plates of the device frame R and the air guiding parts 13 limit chambers B_1 at the side of the device. Air guiding part 13 and side plates 10b are shaped in such a way that the combined airflow $L_1 + L_2$ will flow in a horizontal direction to the side and preferably in the direction of the ceiling level and along this.

There is preferably an aperture plate 16b1 in between the air guiding parts 13 of the device, whereby the circulated airflow L_2 conducted through the aperture plate is guided further into side chambers B_1. As was described above, the combined air flow $L_1 + L_2$ is guided away from the device, preferably with the aid of air guiding parts 13 guided by these in a horizontal direction to the side. The device is symmetrical in relation to vertical central axis Y_1.

In this context we refer to Figures 10A–10J, which show various location positions of supply air terminal devices in the room space. Thus, even though an advantageous ceiling embodiment was presented above, the device may also be used in a wall position or floor position or freely mounted. The same applies to the other device embodiments presented in this application.

Figures 1C, 1D and 1E show an embodiment otherwise similar to the one shown in Figures 1A and 1B, except that the device is equipped with a control device 15 for the induction ratio between flows L_2 and L_1.

In order to control the induction ratio Q_2/Q_1 between flows L_1 and L_2, the embodiment shown in Figure 1B includes in between the air guiding parts 13 an induction ratio control device 15, which is used to control the flow volume of circulated airflow L_2. Hereby the induction ratio Q_2/Q_1 is controlled, wherein Q_2 is the flow volume of the circulated airflow L_2, while Q_1 is the flow volume of the supply airflow, that is, the primary airflow L_1. With devices according to the invention, the maximum induction ratio Q_2/Q_1 is typically in a range of 2–6.

The induction ratio control device 15 of the embodiment shown in Figures 1C, 1D and 1E is formed by an aperture plate structure. The structure includes a second aperture plate $16a_2$ movable in relation to a first aperture plate $16a_1$ located in a fixed position (arrow S_1 indicates the linear motion), whereby the apertures $a_1,a_2\ldots$, $b_1,b_2\ldots$ in aperture plates $16a_1,16a_2$ can be placed in covering positions in relation to each other, whereby the total cross-sectional flow area through the aperture surface structure can be controlled and the circulated airflow L_2 through the aperture surface can thus be controlled. In certain service conditions the flow L_2 can be closed off entirely.

Figure 2 shows an embodiment otherwise similar to the one shown in Figure 1C, except that here each side chamber B_1 includes a control device 15 for controlling the induction ratio between flows L_1 and L_2. In the embodiment shown in Figure 2, control device 15 is formed by an elongated damper 17, which can be turned supported by hinge 18 into different control positions in chamber B_1. By turning an eccentric piece 19 the damper 17 is moved and different control positions are obtained for damper 17.

Figure 3A shows an embodiment of the invention, wherein the induction ratio control device 15 for controlling the induction ratio between the circulated airflow L_2 and the primary airflow L_1 is formed by an elongated plate 20, which is moved in a linear direction to close and open a flow path E_1 for cir-

culated airflow L_2 into mixing chamber B_1. Plate 20 of control device 15 closes and opens a flow path into side chamber B_1. Plate 20 is located on one edge of side chamber B_1 in the upper part of chamber B_1. By moving plate 20 to various control positions, flow L_2 is throttled, and at the same time the length of the flow path of flow L_2 is affected and thus the induction distance is affected, that is, that distance over which supply airflow L_1 induces the circulated airflow L_2.

Figure 3B is an axonometric view of the structure shown in Figure 3A. Plate 20 can be positioned in different positions in relation to plate 13. Screw R_1 is placed through groove u1 in plate 20 to be mounted to the plate, that is, to air guiding part 13 in its mounting hole.

Figure 3C shows an embodiment of the invention, which is otherwise similar to the embodiment shown in Figure 3A and in Figure 3B, except that plate 20 is formed as a turning damper 30, which is turned around pivot point N_1 located close to nozzles $12a_1$,$12a_2$ on a side surface of supply air chamber 11.

Figure 3D shows a supply air terminal device according to the invention, including nozzles $12a_1$,$12a_2$ opening from a supply air chamber, whereby the supply air flow L_1 is conducted through the nozzles directly to be close to ceiling K_a in the room, where due to the coanda effect it will cling and flow along the ceiling. Supply airflow L_1 induces a circulated airflow L_2 centrally through the device, and the induction ratio Q_2/Q_1 between the flows L_2 and L_1 is controlled by an induction ratio control device 15, which includes a turning damper 20 turning at pivot point N_1 in supply air chamber 11. The structure is symmetrical in relation to vertical central axis Y_1.

Figure 4A shows an embodiment of the invention, wherein the induction ratio control device 15 is fitted in connection with nozzles $12a_1$,$12a_2$..., $12b_1$, $12b_2$... in such a way that on the supply side of the nozzles (in relation to flow

L_1) there is an aperture plate 24, which can be brought into different covering positions in relation to the supply apertures $j_1,j_2...$; n_1,n_2 of the nozzles $12a_1$ $12a_2$, $12b_1$ $2b_2$

Figure 4B shows the area $X_1$of Figure 4A on an enlarged scale. By moving control plate 24 in a linear direction as shown by arrow S_1, the position of apertures f_1,f_2 t_1,t_2 in control plate 24 is affected in relation to supply apertures $j_1,j_2...$; $n_1,n_2...$ of the nozzle rows $12a_1,12a_2...$, $12b_1,12b_2...$ When in addition the nozzles $12a_1,12a_2...$, $12b_1,12b_2...$ are chosen as desired in relation to each other, it is possible by changing the flow between the nozzle rows to obtain the desired throw pattern and flow velocity for the primary airflow L_1 from the primary airflow nozzles and thus the desired induction ratio is obtained between flows L_1 and L_2. In the embodiment shown in Figure 4A, supply air chamber 11 includes two nozzle rows side by side; a nozzle row formed by nozzles $12a_1,12a_2...$, wherein the cross-sectional flow area of the nozzles is larger than the cross-sectional flow area of the nozzles $12b_1,12b_2...$ in the lower row of nozzles. In addition, nozzles $12a_1,12a_2...$ extend longer into side chamber B_1 than the lower nozzles $12b_1,12b_2...$ By moving aperture plate 24 in a linear direction as shown by arrow S_1 in Figure 4B, the airflow through nozzles $12a_1,12a_2...$, $12b_1,12b_2...$ is controlled. Thus, by moving aperture plate 24 in a linear direction (arrow S_1) in relation to supply apertures $j_1,j_2...$; n_1, $n_2...$, the supply airflow L_1 is throttled and controlled as desired.

Figure 5 shows an embodiment of the supply air terminal device according to the invention, wherein the supply air chamber 11 is formed by a structure having a circular cross-section and including on both sides of central axis Y_1 nozzles $12a_1,12a_2...$, $12b_1,12b_2...$, however, so that as is shown in the figure, the nozzles $12b_1,12b_2...$ having the smaller cross-sectional flow area are located on the left side above the row of nozzles $12a_1,12a_2...$ having the larger cross-sectional flow area, and in the figure the order of nozzles is the other

way round on the right side of central axis Y_1, that is, the row of nozzles $12b_1$, $12b_2$... having the smaller cross-sectional flow area is located below the row of nozzles $12a_1$,$12a_2$... having the larger cross-sectional flow area. Inside supply air chamber 11 in the induction ratio control device 15 there is a turning control tube 27 including flow apertures f_1,f_2..., t_1,t_2... for the nozzles $12a_1$, $12a_2$..., $12b_1$,$12b_2$... located on both sides of central axis Y_1. Thus, by turning control tube 27 the supply air can be made to flow e.g. as shown in the figure only through the nozzles $12a_1$,$12a_2$... having the larger cross-sectional flow area, or through the nozzles $12b_1$,$12b_2$... having the smaller cross-sectional flow area. In this manner the velocity of flow L_1 and the throw pattern in side chamber B_1 can be controlled and thus the induction ratio of the said flow L_1 to flow L_2 can be controlled. By controlling flow L_1 it is thus possible to control the induction ratio between the flows L_2 and L_1 as desired. Supply air chamber 11 with a circular cross-section is located centrally in the structure. In the embodiment shown in the figure, the device includes a top ceiling plate 10c connecting side plates 11b, whereby the structure is formed as shown in the figure as a structure open at the top and closed on the sides and at the bottom.

Figure 6A shows an embodiment of the invention, wherein the supply air terminal device includes a supply air chamber 11 and on its sides a side plate 10b, whereby between side plate 10b and supply air chamber 11 a flow path 40 is left for the circulated airflow L_2. The device is open at the top and at the bottom and it thus includes flow apertures T_1 and T_2 in the top and bottom parts of the device; flow apertures T_1 for the circulated airflow L_2 and flow apertures T_2 for the combined flow $L_1 + L_2$ leaving the device. Through the nozzles $12a_1$,$12a_2$...; $12b_1$,$12b_2$... located on the side surface of supply air chamber 11 and located in rows over the length of the device the supply air flow, that is, the primary airflow L_1 is conducted into mixing chamber B_1 below flowing path 40. The said primary airflow L_1 induces the circulated airflow L_2 from aperture T_1 through flow path 40 into mixing chamber B_1, and

the combined airflow $L_1 + L_2$ is conducted sideways from the device guided by side plate 10b and air guiding part 13 of the device.

It is possible within the scope of the invention to control the induction ratio between flows L_2 and L_1 by arranging the central flow guiding part 130 of the structure to be movable in relation to supply air chamber 11. Such an embodiment may also be possible within the scope of the invention, wherein the side plates 10b of the device are arranged to be movable in relation to supply air chamber 11. The transfer is indicated by arrows M_1.

Figure 6B shows an embodiment, wherein side plate 10b of the device includes an associated turning control damper 30 as the induction ratio Q_2/Q_1 control device 15. Control damper 30 is fitted to be turning around pivot point N_1. Control can be performed either manually or by a motor by remote operation. By changing the position of control damper 30 the induction ratio between the flows L_2 and L_1 can be controlled.

Figure 7A shows an embodiment of the invention, which is especially suitable for mounting on a wall J. As shown by the figure, supply air chamber 11 in the same way as in the previous embodiment includes nozzle rows of nozzles $12a_1, 12a_2$... and $12b_1, 12b_2$..., whereby the supply airflow L_1, preferably fresh supply air, is conducted through the nozzles of the nozzle rows into mixing chamber B_1, and the said primary airflow L_1 draws along circulated air from room H, whereby the circulated airflow is indicated by arrows L_2 in the figure. The said circulated airflow L_2 or secondary airflow is conducted to join flow L_1 in mixing chamber B_1 through the elongated flow aperture 31 in side plate 10b of the device. The device includes end plates 10d. The combined airflow $L_1 + L_2$ is conducted out of the device obliquely upwards and preferably close to ceiling D in room H, where the combined airflow $L_1 + L_2$ clings to the ceiling due to the coanda effect and flows forward in the room space close to ceiling D.

Figure 7B shows an embodiment otherwise similar to the one in Figure 7A, except that in this embodiment the control damper 30 functioning as the induction ratio control device 15 is fitted close to the nozzle rows and it turns around pivot point N_1. Thus, by turning control damper 30 the induction ratio Q_2/Q_1 can be controlled, that is, that ratio in which flow L_1 induces or draws along the circulated airflow L_2 from room space H. Pivot N_1 is fitted into the side surface of supply air chamber 11. Damper 30 can be turned either manually or by remote control by a motor, preferably by an electric motor.

Figure 8A shows an embodiment of the invention, wherein the supply air terminal device includes a supply air chamber 11 and on its both sides on both sides of central axis Y_1 side plates 10b, whereby between each side plate 10b and supply air chamber 11 a flow path 40 remains for the circulated airflow L_2 of the room space or such through the device. Thus, as shown in the figure, the device is open both at the top and at the bottom, and it includes flow apertures T_1 for the circulated airflow L_2 in the top part of the device as shown in the figure and a central flow aperture T_2 in the bottom part of the device for the combined supply and circulated airflows $L_1 + L_2$. The nozzles $12a_1, 12a_2 \ldots 12b_1, 12b_2 \ldots$ located in two nozzle rows direct supply airflow L_1 downwards as shown in the figure. With the aid of the said supply airflow L_1 a circulated airflow L_2 is induced from room space H. The combined airflow $L_1 + L_2$ flows downwards from the device according to the embodiment shown in the figure.

Such an embodiment of the induction ratio control device 15 is possible within the scope of the invention, wherein side plates 10b are fitted to be movable in relation to supply air chamber 11 as shown by arrows M_1 in the figure.

Figure 8B shows a control damper 30 as the induction ratio control device 15, which damper is fitted to turn around pivot point N_1, whereby pivot point N_1 is located in supply air chamber 11 on its side surface. By turning damper 30 manually or by a motor the induction ratio between flows L_2 and L_1 can be

controlled. Figure 8B also shows such an embodiment with dashed lines, wherein instead of a turning damper 30 the damper can be moved in a linear direction on the side wall of the supply air chamber either manually or by a motor in order to control the induction ratio between flows L_2 and L_1.

Figure 9A shows an embodiment of the invention, wherein as shown by the figure supply air terminal device 10 includes a structure open both at the top and on the sides. Supply air chamber 11 includes nozzles $12a_1, 12a_2 \ldots$; $12b_1$, $12b_2 \ldots$ located in two rows and as shown in the figure directing supply airflow L_1 downwards from the device. As the figure shows, the device includes a lower supply aperture T_1 for the circulated airflow L_2 and a lower discharge aperture T_2 for the combined airflow $L_1 + L_2$. Thus, the supply airflow L_1 conducted from the nozzles will induce a circulated airflow L_2 to flow first into side chamber B_1 in between separating plate 33 and side plate 10b and further through the free flow path E_1 between separating plate 33 and supply air chamber 11 to join supply airflow L_1. Thus circulated airflow L_2 turns in a direction of close to 180° after joining the supply airflow L_1. The combined airflow $L_1 + L_2$ flows in between separating plates 33 centrally in the device and downwards.

Such an embodiment is possible within the scope of the invention, wherein the induction ratio control device 15 is formed by movable separating plates 33, which are fitted to be movable towards supply air chamber 11 and away from it. Arrows M_1 show the said transfer and the induction ratio control.

As is shown in Figure 9B, a control damper 30 is located in between separating plate 33 and supply air chamber as the control device 15 for controlling the induction ratio between flows L_2 and L_1, which damper 30 is fitted to pivot around pivot point N_1 from supply air chamber 11 controlled either manually or by remote control by a motor, e.g. an electric motor. By turning damper 30, the induction ratio Q_2/Q_1 between the flows L_2 and L_1 can be controlled. With

the device according to the invention, an induction ratio Q_2/Q_1 typically in a range of 2–6 is achieved.

Figures 10A–10J show some advantageous positions of devices according to the invention. The devices according to the invention may be located either in the ceiling of the room or at a distance from it close to ceiling K_a of the room, or devices 10 may be located on a wall or in the floor L_a.

As is shown in Figure 10A, the supply air terminal device 10 is fitted in ceiling K_a of the room and it is arranged to direct the supply airflow $L_1 + L_2$ on both sides of the central axis of the device close to the ceiling. The device solutions shown in the embodiments of Figure 1A and Figure 6A are suitable, among others, for the solution shown in Figure 10A.

Figure 10B shows an embodiment, wherein flow jets $L_1 + L_2$ are directed on both sides of the central axis of the device and obliquely downwards into the room space. For example, the device solutions shown in Figures 1A and 9A are suitable for the embodiment according to Figure 10B.

Figure 10C shows an embodiment, which blows the supply air jet $L_1 + L_2$ on one side of the device only and close to the ceiling. For example, the device solutions shown in Figure 1A and in Figure 7A are suitable for the embodiment according to Figure 10C.

Figure 10D shows an embodiment of the invention, which blows the supply air jet $L_1 + L_2$ directly downward, and the device is fitted at a distance from the ceiling. The device solutions of Figure 8A and Figure 9A are suitable for the embodiment shown in this figure.

Figure 10E shows an embodiment, wherein the supply air jet is directed on both sides and wherein the device solution is located at a distance from the

ceiling. The device solutions according to Figure 1A and Figure 6A are suitable for the embodiment shown in this figure.

Figure 10F shows a floor embodiment, wherein the device is located under the floor and it is arranged to blow the supply air jets in two opposite directions at the floor surface level. The device solutions according to Figures 1A, 6A and 7A are suitable for the embodiment shown in this figure.

Figure 10G shows an embodiment, which blows the supply air jet from the floor directly upwards. The device solutions according to Figures 8A and 9A are especially suitable for the solution according to the embodiment of this figure.

Figure 10H shows the device in a wall position, and the device blows the supply air jet directly in the normal direction of the wall. The device solutions shown in Figures 7A, 8A and 9A are especially suitable for the embodiment of this figure.

Figure 10I shows a wall embodiment, wherein the device blows obliquely close to the ceiling. The device solutions shown in Figures 7A, 8A and 9A are especially suitable for the supply of air shown in this figure.

Figure 10J shows an embodiment of the invention, wherein the air is directed from the supply air terminal device in a parallel direction with the wall surface and the device is located in a lower part of the wall. The device solution according to Figure 7A is especially suitable for the supply of air shown in Figure 10J.

It is obvious that in the above-mentioned positions such a device may be used, which includes an induction ratio control device.

Claims

1. Supply air terminal device (10), **characterised** in that

a) the supply air terminal device includes a supply air chamber (11) and from this several nozzles ($12a_1, 12a_2 \ldots$; $12b_1, 12b_2 \ldots$) or a nozzle gap, through which a supply airflow (L_1) is conducted into a mixing chamber (B_1) inside the device,

b) and that the supply air terminal device includes a flow aperture (T_1) on some side of the device, through which a circulated airflow (L_2) is conducted from the room, whereby the said circulated airflow is conducted to join the supply airflow (L_1) induced by the supply airflow (L_1), and that the flows combine in the mixing chamber (B_1) inside the device, and that the combined airflow ($L_1 + L_2$) of the supply airflow (L_1) and the circulated airflow (L_2) is made to flow further out of the device (FIG. 1A - FIG. 9B).

2. Supply air terminal device according to claim 1, **characterised** in that the mixing chamber (B_1) opens through a flow gap (T_2) into the room space (H) (FIG. 1A - FIG. 9B).

3. Supply air terminal device according to claim 1 or 2, **characterised** in that the device includes a supply air chamber (11) and on its side at a distance from it a side plate (10b) and that the device is open at the top and at the bottom in such a way that it includes flow apertures (T_1, T_2) in the top and bottom parts of the device, whereby the mixing chamber (B_1) is open at the top and at the bottom, and that supply air chamber (11) includes a nozzle gap or nozzles ($12a_1, 12a_2 \ldots$; $12b_1, 12b_2 \ldots$) located on a side surface, through which the supply airflow (L_1) is conducted into mixing chamber (B_1), whereby the supply airflow (L_1) induces a circulated airflow to flow through flow apertures (T_1) into mixing chamber (B_1), and that the combined airflow ($L_1 + L_2$) of the supply airflow (L_1) and the circulated airflow (L_2) flows away from the device through the aperture (T_2) in mixing chamber (B_1). (FIG. 6A).

4. Supply air terminal device according to the preceding claim, **characterised** in that the side plate (10b) includes an associated turning control damper (30) arranged to turn around a pivot point (N_1) in order to control the induction ratio between the flows (L_1 and L_2). (FIG. 6B).

5. Supply air terminal device according to any one of the preceding claims 1, 2 or 3, **characterised** in that the induction ratio control device (15) is formed by an arrangement, wherein a side plate (10b) is movable (arrow M_1) in relation to the supply air chamber (11).

6. Supply air terminal device according to claim 1, **characterised** in that the equipment includes a mixing chamber (B_1) located between the supply air chamber (11) and the side plate (10b), into which mixing chamber the supply airflow (L_1) is conducted, and that the said supply airflow (L_1) draws along a circulated airflow (L_2) from the room to join itself in the mixing chamber (B_1) through a flow aperture (31) in the side plate (10b), and that the combined airflow ($L_1 + L_2$) is conducted out of the device obliquely upwards, preferably close to the ceiling (FIG. 7A).

7. Supply air terminal device according to the preceding claim, **characterised** in that there is a control damper (30), which can be turned into different control positions, and that the control damper (30) is joined in association with the supply air chamber (11) close to nozzles ($12a_1$,$12a_2$...; $12b_1$,$12b_2$...), whereby the damper functions as a control device for the induction ratio between the flows (L_1,L_2). (FIG. 7B).

8. Supply air terminal device according to claim 1, **characterised** in that the supply air chamber (11) includes side plates (10b) on both sides, whereby a flow path (40) remains in between the supply air chamber (11) and the side plate (10b), and that the side chamber (B_1) in its top part includes a flow aper-

ture (T_1) for the circulated airflow (L_2), and that the supply airflow (L_1) is conducted from the supply air chamber (11) through nozzles ($12a_1, 12a_2...$; $12b_1, 12b_2...$) downwards towards the lower flow aperture (T_2), whereby the supply airflow (L_1) induces the circulated airflow (L_2) to flow to join itself and the combined airflow ($L_1 + L_2$) is made to flow through the flow aperture (T_2) and out of the device. (FIG. 8A).

9. Supply air terminal device according to the preceding claim, **characterised** in that the equipment as the induction ratio control device includes a control damper (30), which is fitted on a side surface of the supply air chamber (11), whereby by turning the damper (30) the induction ratio between the flows (L_2 and L_1) can be controlled. (FIG. 8B).

10. Supply air terminal device according to claim 1, **characterised** in that the supply air terminal device includes a supply air chamber (11), and that the supply air terminal device is a structure open at the top and closed on the sides and it includes two separating walls (33), whereby each side chamber (B_1) of the device is limited by a side plate (10b) of the device and by one separating wall (33), and that between the separating walls (33) there is a discharge aperture (T_2), from which the combined airflow ($L_1 + L_2$) of the supply airflow and the circulated airflow leaves the device, whereby the supply air chamber (11) includes nozzles ($12a_1, 12a_2...$; $12b_1, 12b_2...$), which are directed from between the central separating walls (33) of the device towards the discharge aperture (T_2), whereby the supply airflow (L_1) is directed downwards, which supply airflow (L_1) induces the circulated airflow (L_2) to flow to join the supply airflow (L_1) first in the side chamber (B_1) and further out of the side chamber (B_1) to the centre of the device, and that the combined airflow ($L_1 + L_2$) is conducted out of the device between the separating walls (33) through the discharge aperture (T_2) (FIG. 9A).

11. Supply air terminal device according to the preceding claim, **character-**

ised in that the induction ratio control device (15) is a control damper (30), which is arranged to turn around a pivot point (N_1) associated with the supply air chamber (11), and the control damper (30) is used to control the induction ratio between the circulated airflow (L_2) and the supply airflow (L_1). (FIG. 9B)

12. Supply air terminal device according to claim 10, **characterised** in that the induction ratio control device (15) is an arrangement, wherein the separating walls (33) of the device are arranged to be movable towards the supply air chamber (11) and away from it in order to control the induction ratio between the flows (L_2 and L_1).

13. Supply air terminal device according to claim 1, **characterised** in that the supply air terminal device (10) includes a supply air chamber (11) and from this a nozzle gap or several nozzles ($12a_1$,$12a_2$) for the supply airflow (L_1) into the side chamber (B_1), and that the supply air terminal device is a structure closed on the sides and at the top including side plates (10b) and an air guiding part (13), whereby in the device in between the air guiding parts (13) located on both sides of the central axis (Y_1) of the device there is a free flow path (E_1) below the supply air chamber (11) for the circulated airflow (L_2) arriving from the room (H) into the side chamber (B_1), whereby in the device the supply air chamber (11) includes a nozzle gap or nozzle gaps ($12a_1$,$12a_2$..., $12b_1$, $12b_2$...) to conduct the supply airflow (L_1) into the side chamber (B_1) and to induce the circulated airflow (L_2) with the aid of the said airflow (L_1) from the room space (H) into side chamber (B_1) (FIG. 1A).

14. Supply air terminal device according to claim 13, **characterised** in that the equipment includes a control device (15) for the induction ratio between the circulated airflow (L_2) and the supply airflow (L_1), which control device is used to control in which ratio there is supply air (L_1) and circulated air (L_2) in the combined airflow (L_1,L_2) (FIG. 1B).

15. Supply air terminal device according to claim 13, **characterised** in that the induction ratio control device (15) is fitted in between the air guiding parts (13) (FIG. 1B).

16. Supply air terminal device according to the preceding claim, **characterised** in that the induction ratio control device (15) includes an aperture plate ($16a_1$) located in a fixed position and another movable aperture plate ($16a_2$), whereby by moving the movable aperture plate ($16a_2$) it is possible to control the position of the apertures (a_1,a_2 ...) of the movable aperture plate in relation to the apertures (b_1,b_2...) of the aperture plate (16a1) located in a fixed position, and it is further possible to control the total cross-sectional flow area for the circulated airflow (L_2) through the aperture plates ($16a_1,16a_2$) (FIG. 1C, FIG. 1D, FIG. 1E).

17. Supply air terminal device according to claim 14, **characterised** in that the side chamber (B_1) includes an induction ratio control device (15), which is formed by a turning control damper (17), which can be made to open and close the flow ($L_1 + L_2$) in the side chamber (B_1) (FIG. 2).

18. Supply air terminal device according to claim 14, **characterised** in that the induction ratio control device (15) is fitted in the top part of the side chamber (B_1) at its one edge to close and open a flow path (14) into the side chamber (B) (FIG. 3A, FIG. 3B).

19. Supply air terminal device according to the preceding claim, **characterised** in that the induction ratio control device (15) is a straight plate (20), which is moved in a linear direction (arrow S_1) either manually or using an electric motor (FIG. 3A, FIG. 3B).

20. Supply air terminal device according to claim 18, **characterised** in that the control device (15) is a turning damper (30) (FIG. 3C).

21. Supply air terminal device according to claim 14, **characterised** in that the induction ratio control device (15) is formed by a control plate (24) including flow apertures (f_1,f_2...; t_1,t_2...) closing and opening a flow path to nozzles ($12a_1$,$12a_2$..., $12b_1$,$12b_2$...), which are located in two separate rows and which have mutually different cross-sectional flow areas, whereby the induction ratio control device (15) can be used to control the flow either through the nozzles ($12a_1$,$12a_2$...) with the larger cross-sectional flow area or through the nozzles ($12b_1$,$12b_2$...) with the smaller cross-sectional flow area, and thus to control the flow velocity of the primary airflow (L_1) and the throw pattern into side chamber (B_1), and thus also the inducing effect of the said primary airflow (L_1) on the secondary air (L_2) (FIG. 4A, FIG. 4B).

22. Supply air terminal device according to claim 14, **characterised** in that the supply air terminal device (10) includes side plates (10b) and a covering plate (10c) and below this it includes a supply air chamber (26) having a circular cross-section, and that inside it there is a turning control tube (27) and in this there are flow apertures (f_1,f_2...; t_1,t_2...) on both sides of the vertical central axis (Y_1), whereby by turning control tube (27) its position can be controlled in relation to the nozzles ($12a_1$,$12a_2$..., $12b_1$,$12b_2$...) located in two separate rows, whereby the nozzles ($12a_1$,$12a_2$...) have a cross-sectional flow area different from that of the nozzles ($12b_1$,$12b_2$...) in the other row, whereby by using the control tube it is possible to control the flow into the nozzles ($12a_1$, $12a_2$..., $12b_1$,$12b_2$...) of the separate nozzle rows and thus to control the flow velocity of the supply airflow (L_1) into side chamber (B_1) and also the inducing effect of supply airflow (L_1) on the circulated airflow (L_2) arriving through flow path (E_1) to join the primary airflow (L_1) (FIG. 5).

23. Supply air terminal device according to claim 14, **characterised** in that the control damper (30) is joined to the supply air chamber through a pivot point (N_1), which control damper can be turned into different control positions in

order to control the induction ratio between the circulated airflow (L_2) and the supply airflow (L_1) (FIG. 3C).

24. Supply air terminal device according to claim 14, **characterised** in that the induction ratio control device (15) is formed by a structural entity (130), which is movable towards the supply air terminal device and away from it and which includes air guiding parts (13) and a structure connecting these, whereby the circulated airflow travels in between the air guiding parts (13) to join the primary airflow (L_1).

AMENDED CLAIMS
[received by the International Bureau on 28 March 2002 (28.03.02);
original claim 1 amended; remaining claims unchanged (1 page)]

1. Supply air terminal device (10), **characterised** in that

a) the supply air terminal device includes a supply air chamber (11) and from this several nozzles ($12a_1, 12a_2 \ldots$; $12b_1, 12b_2 \ldots$) or a nozzle gap, through which a supply airflow (L_1) is conducted into a mixing chamber (B_1) inside the device,

b) and that the supply air terminal device includes a flow aperture (T_1) on some side of the device, through which a circulated airflow (L_2) is conducted from the room, whereby the said circulated airflow is conducted to join the supply airflow (L_1) induced by the supply airflow (L_1), and that the flows combine in the mixing chamber (B_1) inside the device, and that the combined airflow ($L_1 + L_2$) of the supply airflow (L_1) and the circulated airflow (L_2) is made to flow further out of the device, and that the circulated airflow is neither heated nor cooled by a heat exchanger, but the circulated airflow arrives from the room space to join the primary airflow directly (FIG. 1A - FIG. 9B).

2. Supply air terminal device according to claim 1, **characterised** in that the mixing chamber (B_1) opens through a flow gap (T_2) into the room space (H) (FIG. 1A - FIG. 9B).

3. Supply air terminal device according to claim 1 or 2, **characterised** in that the device includes a supply air chamber (11) and on its side at a distance from it a side plate (10b) and that the device is open at the top and at the bottom in such a way that it includes flow apertures (T_1, T_2) in the top and bottom parts of the device, whereby the mixing chamber (B_1) is open at the top and at the bottom, and that supply air chamber (11) includes a nozzle gap or nozzles ($12a_1, 12a_2 \ldots$; $12b_1, 12b_2 \ldots$) located on a side surface, through which the supply airflow (L_1) is conducted into mixing chamber (B_1), whereby the supply airflow (L_1) induces a circulated airflow to flow through flow apertures (T_1)

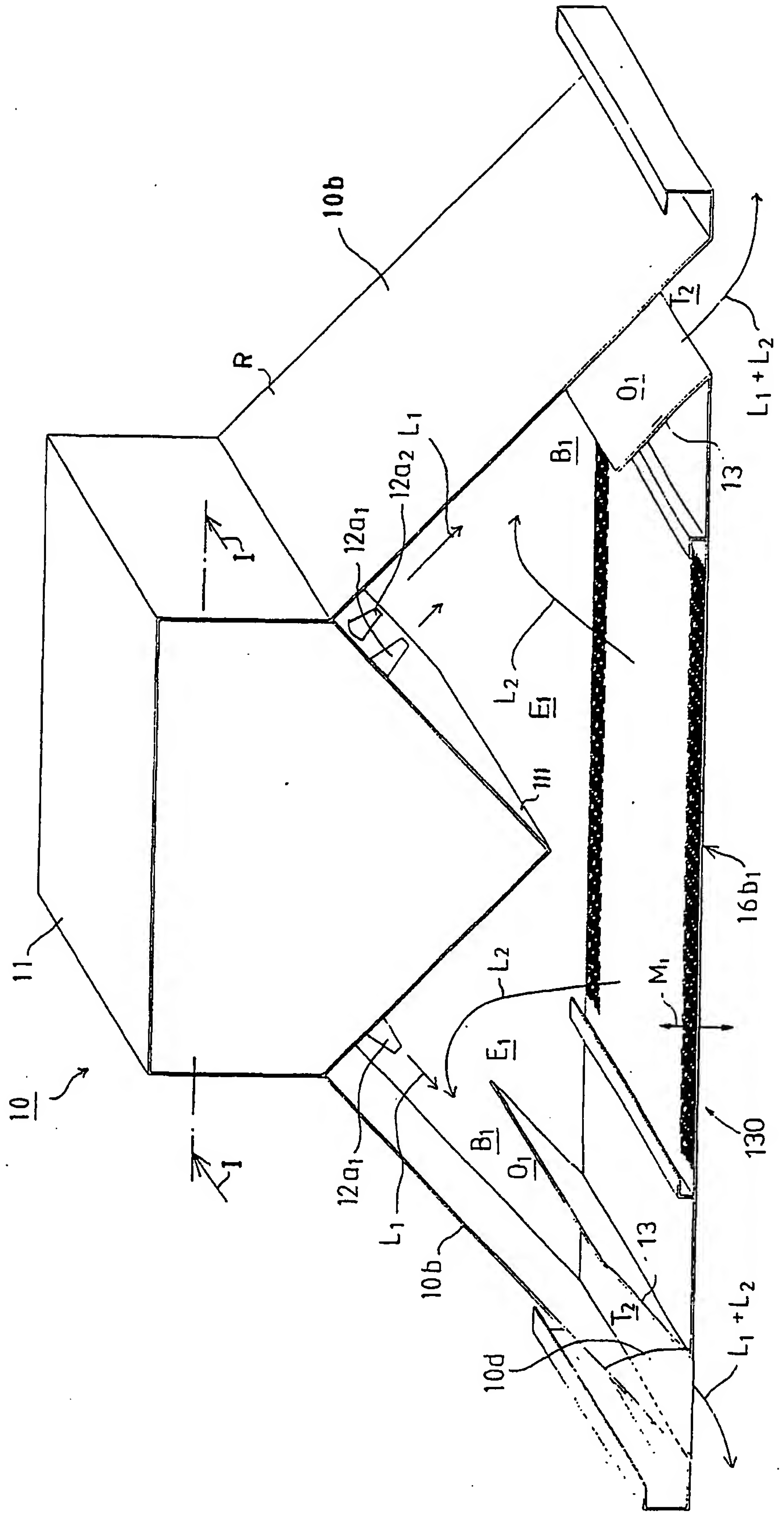


FIG. 1A

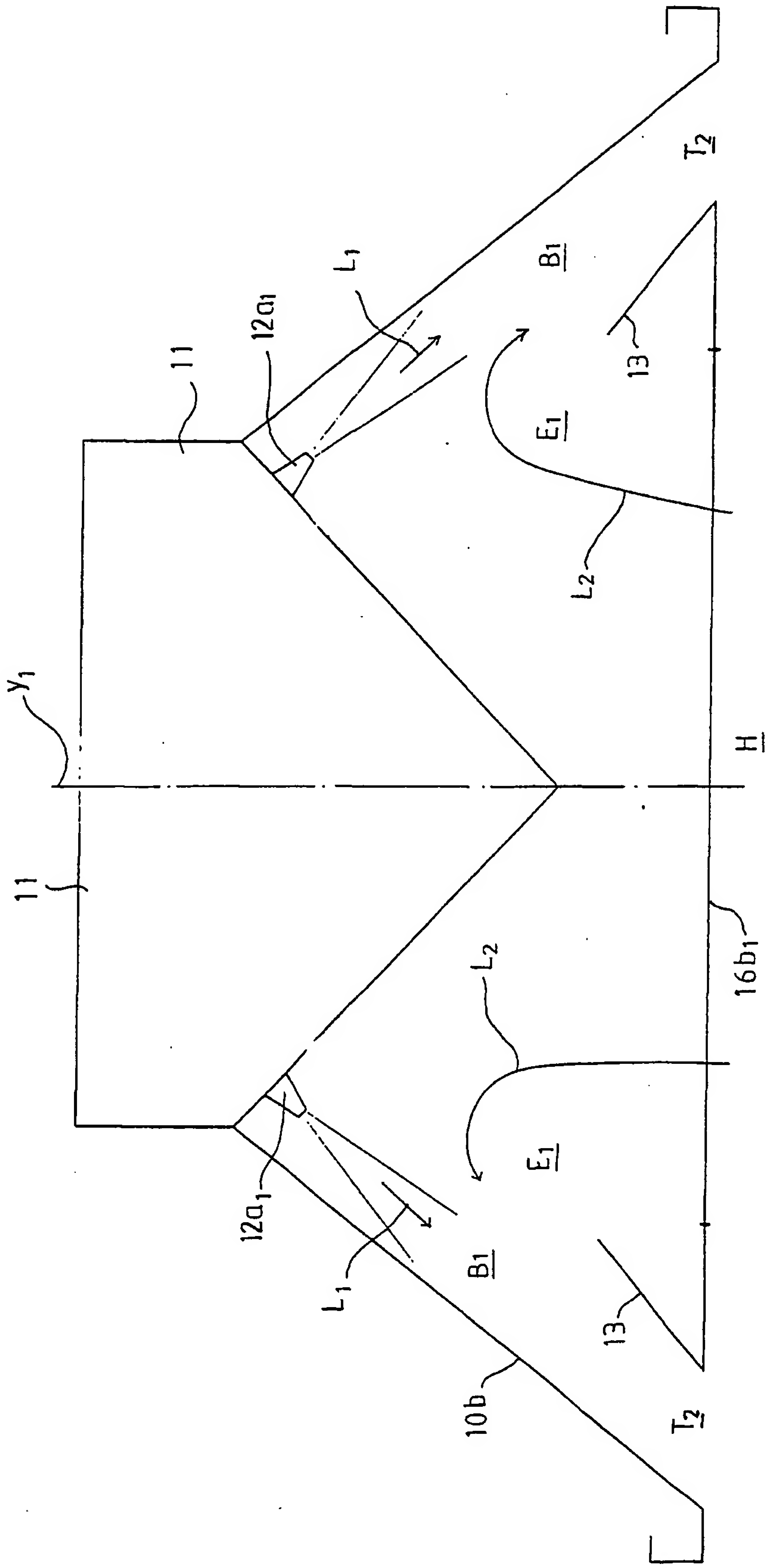


FIG.1B

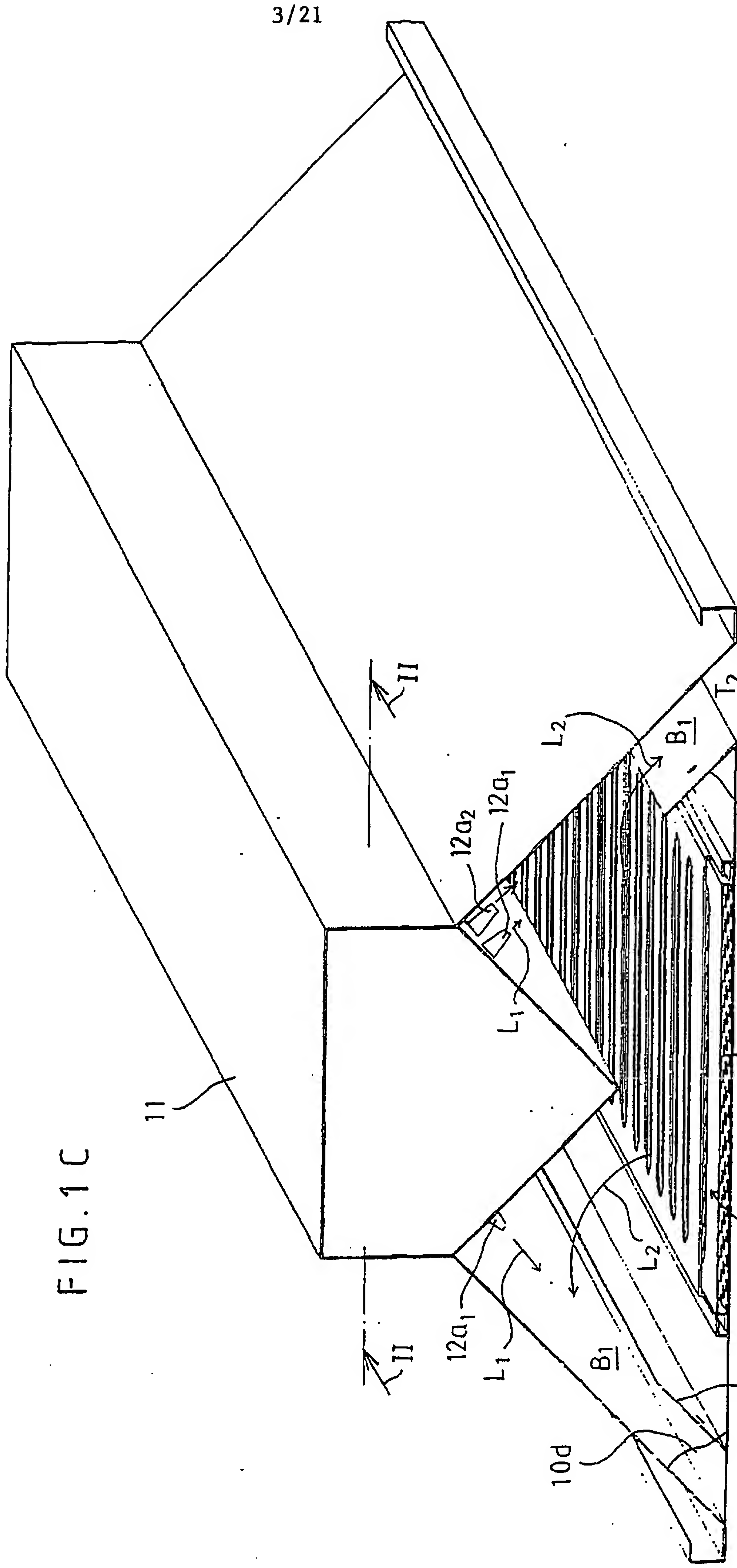


FIG.1C

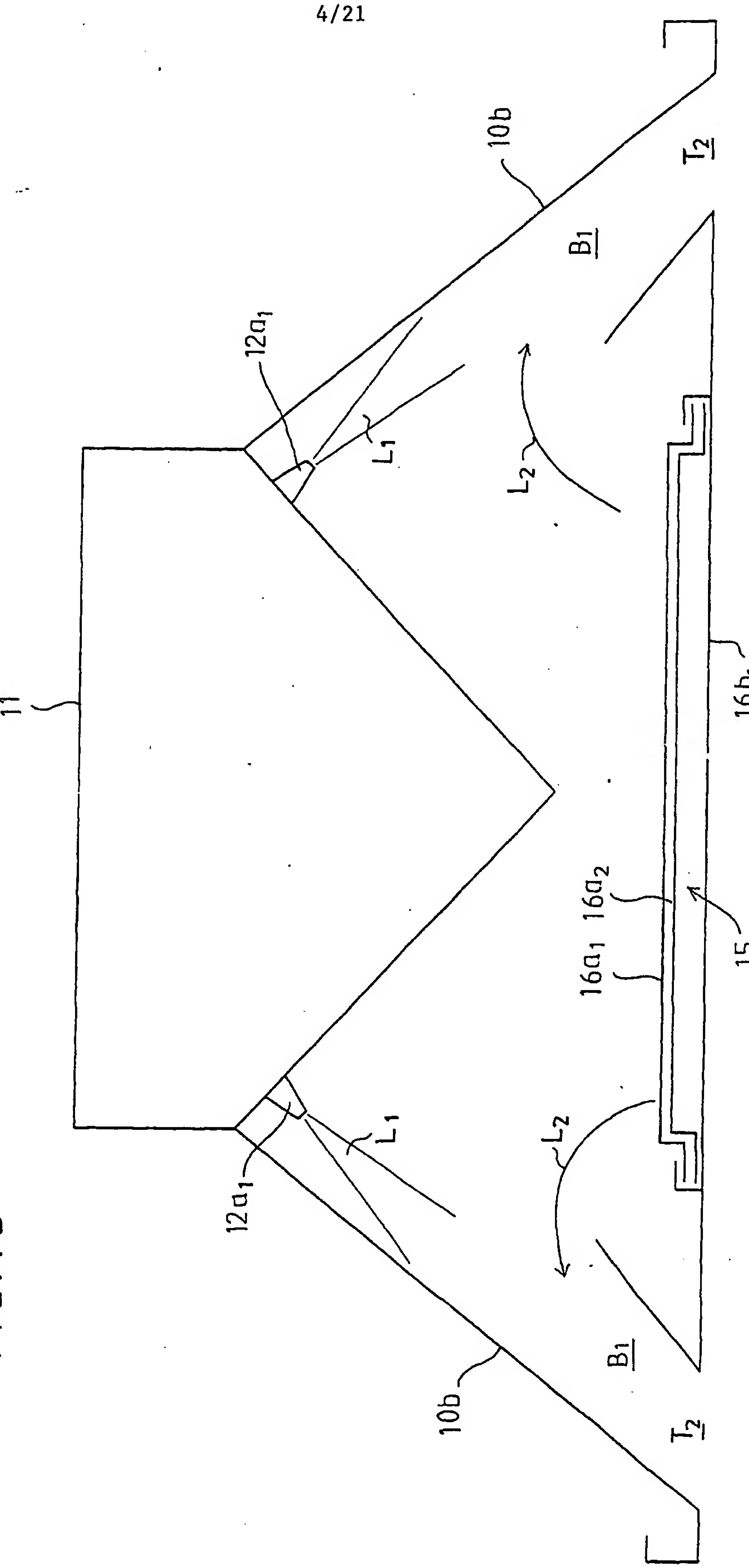


FIG.1D

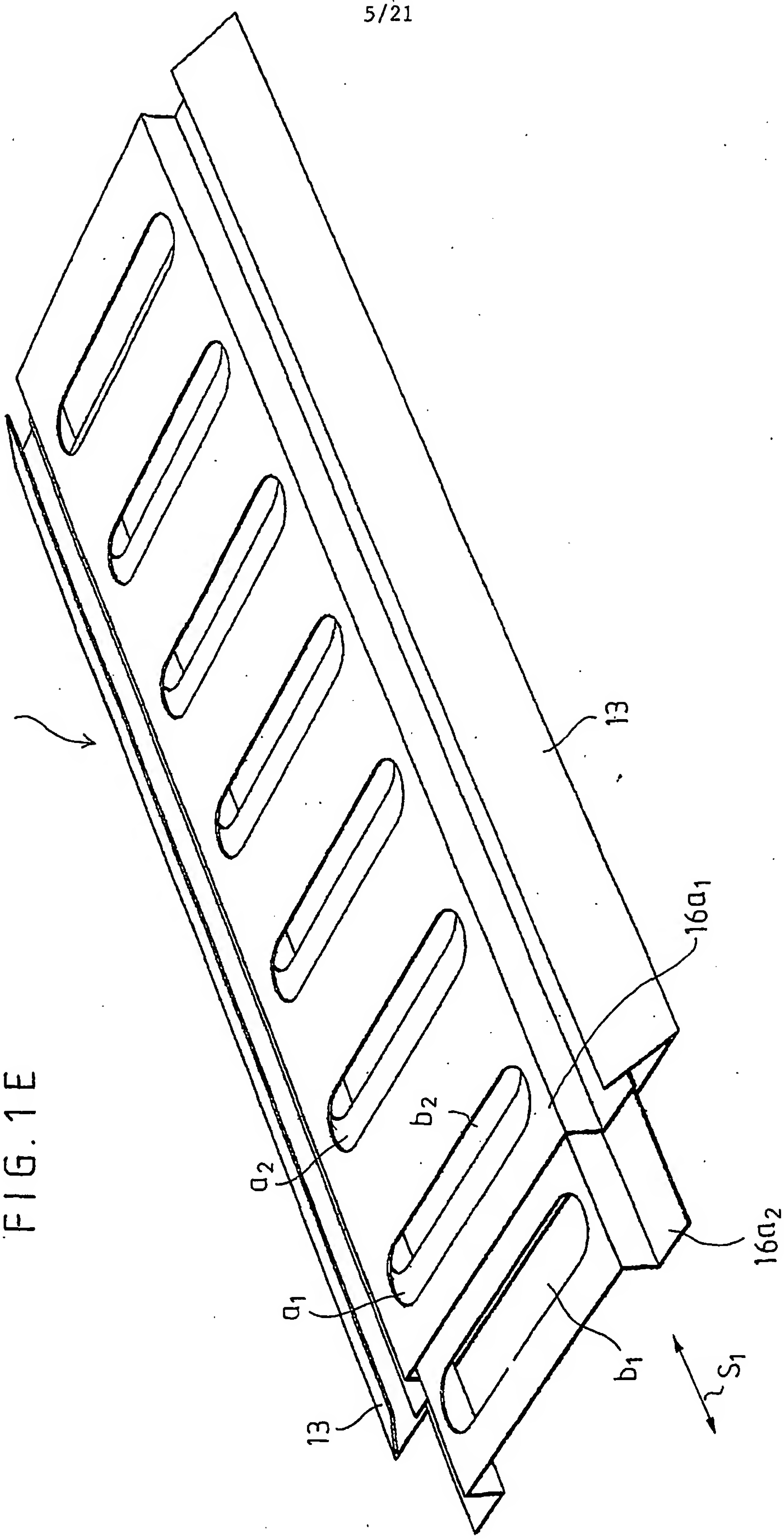


FIG. 1E

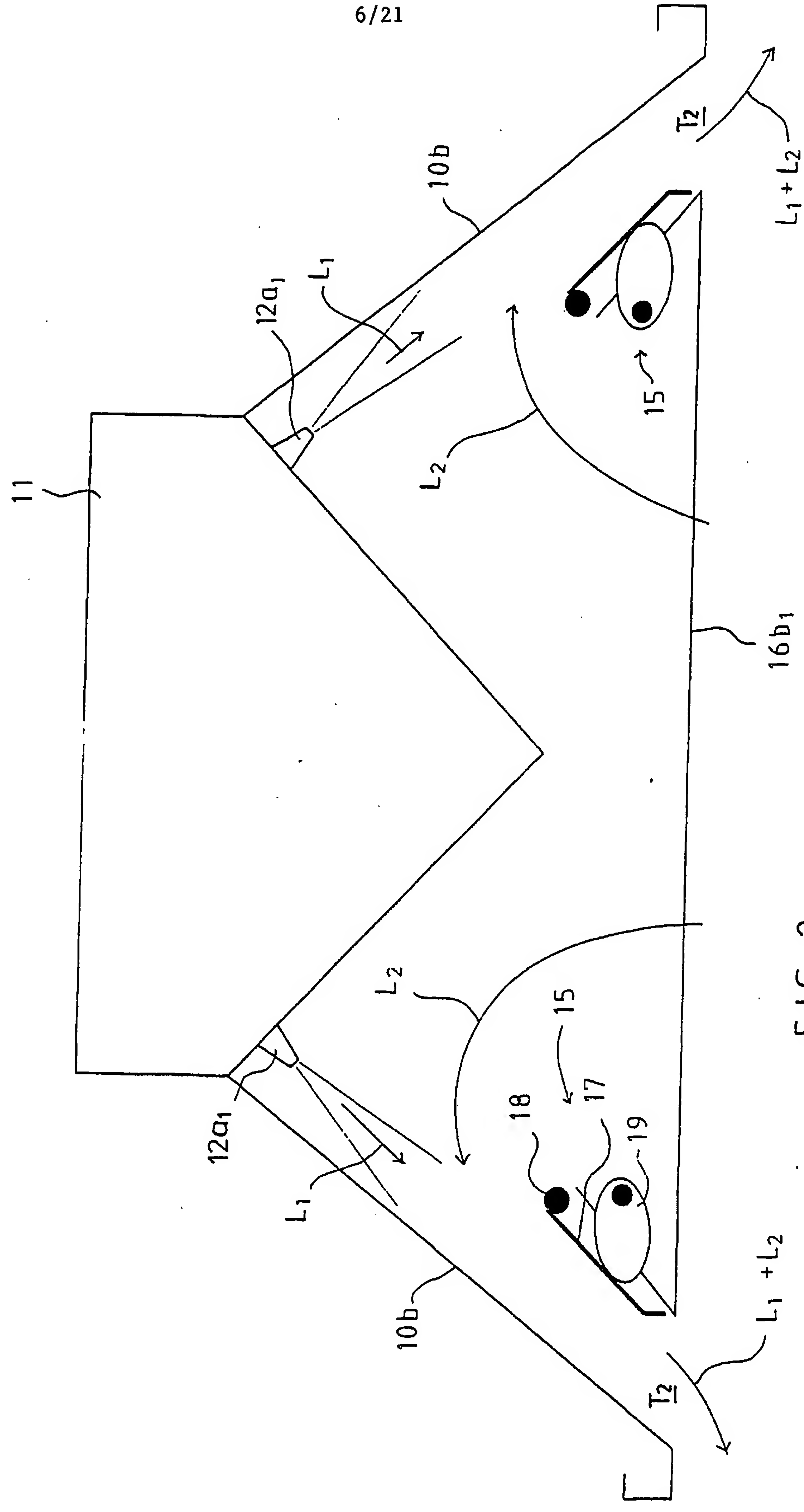


FIG. 2

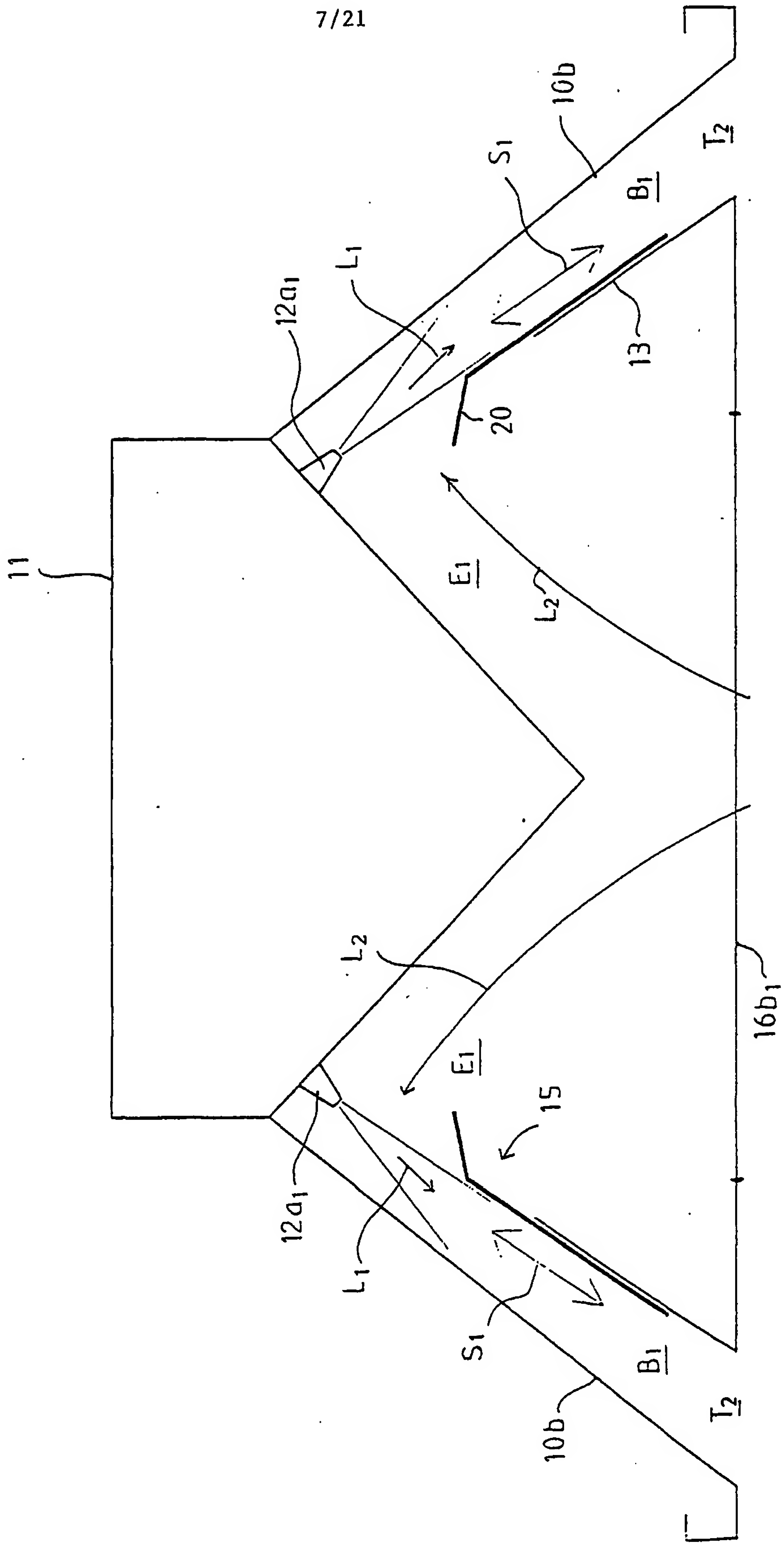


FIG. 3A

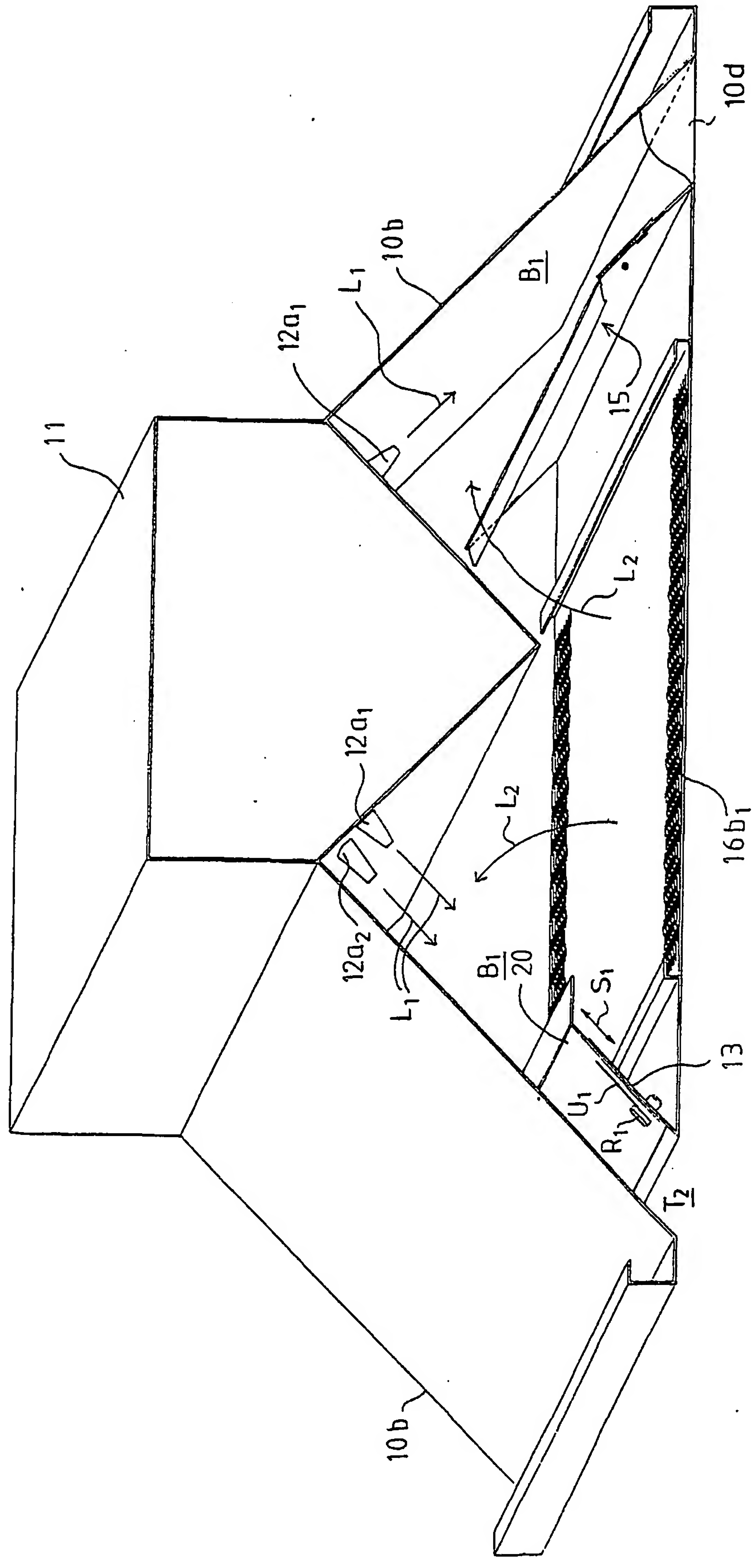

11
12a1
L1
10b
B1
15
L2
10d
12a1
L2
12a2
L1
B1
20
S1
13
U1
R1
T2
16b1
10b

FIG. 3B

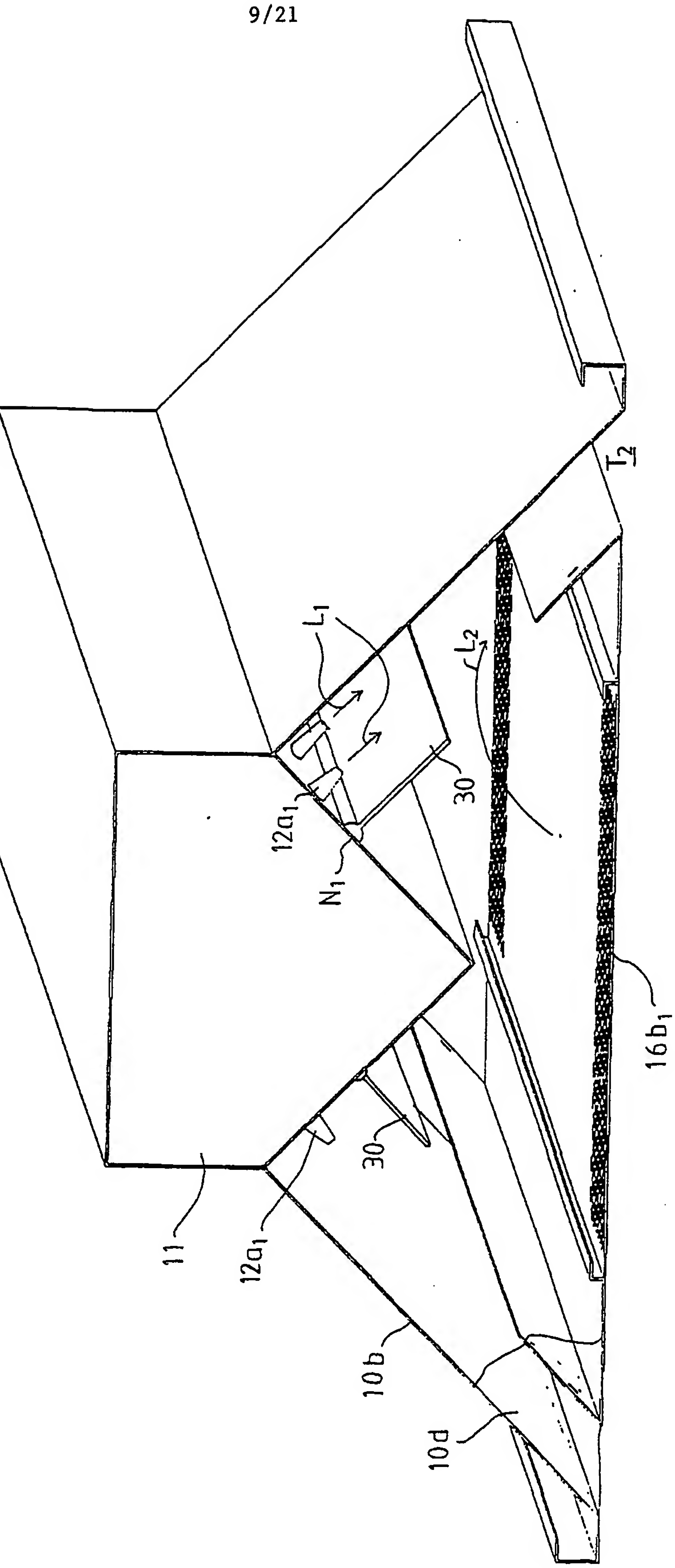


FIG.3C

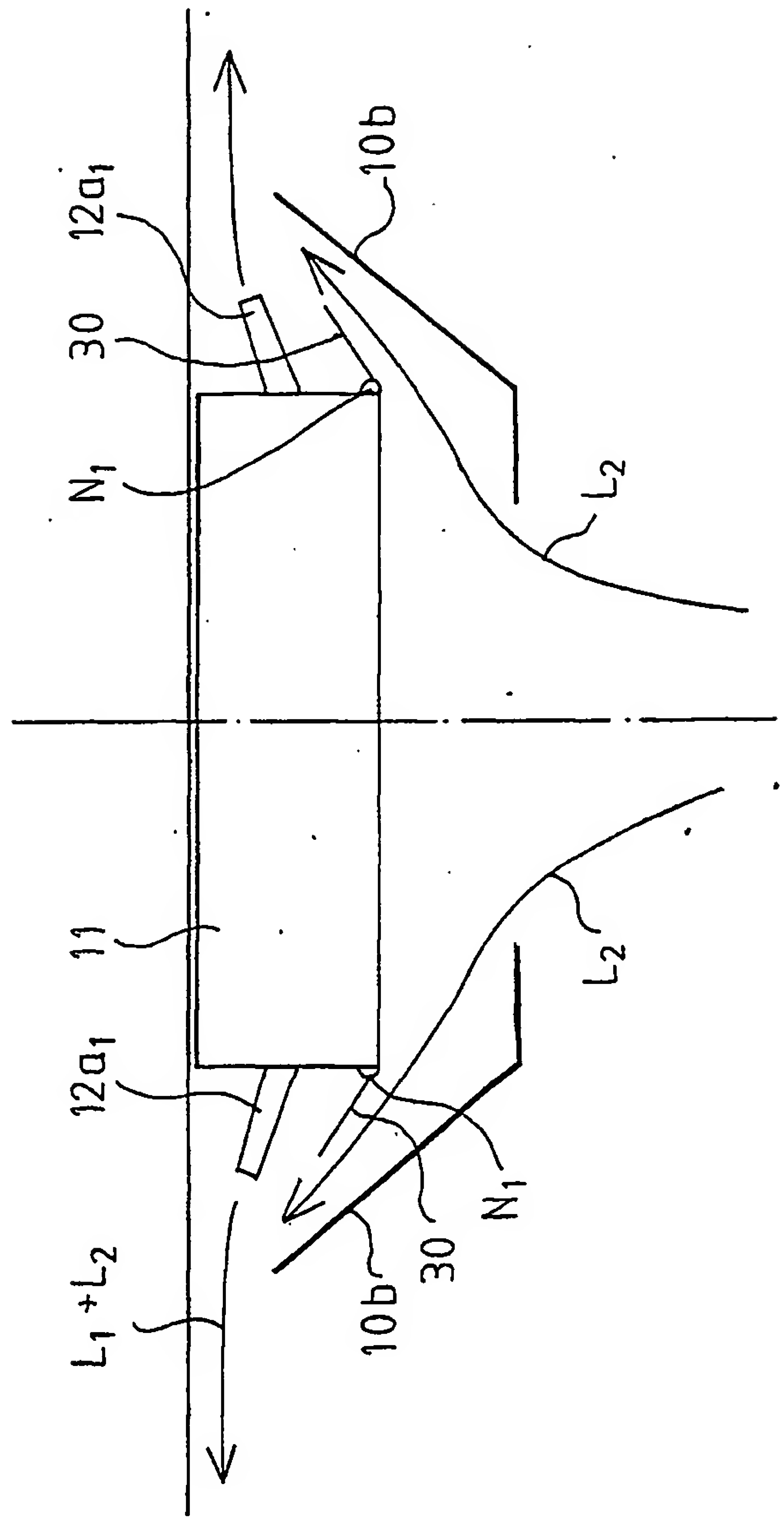


FIG.3D

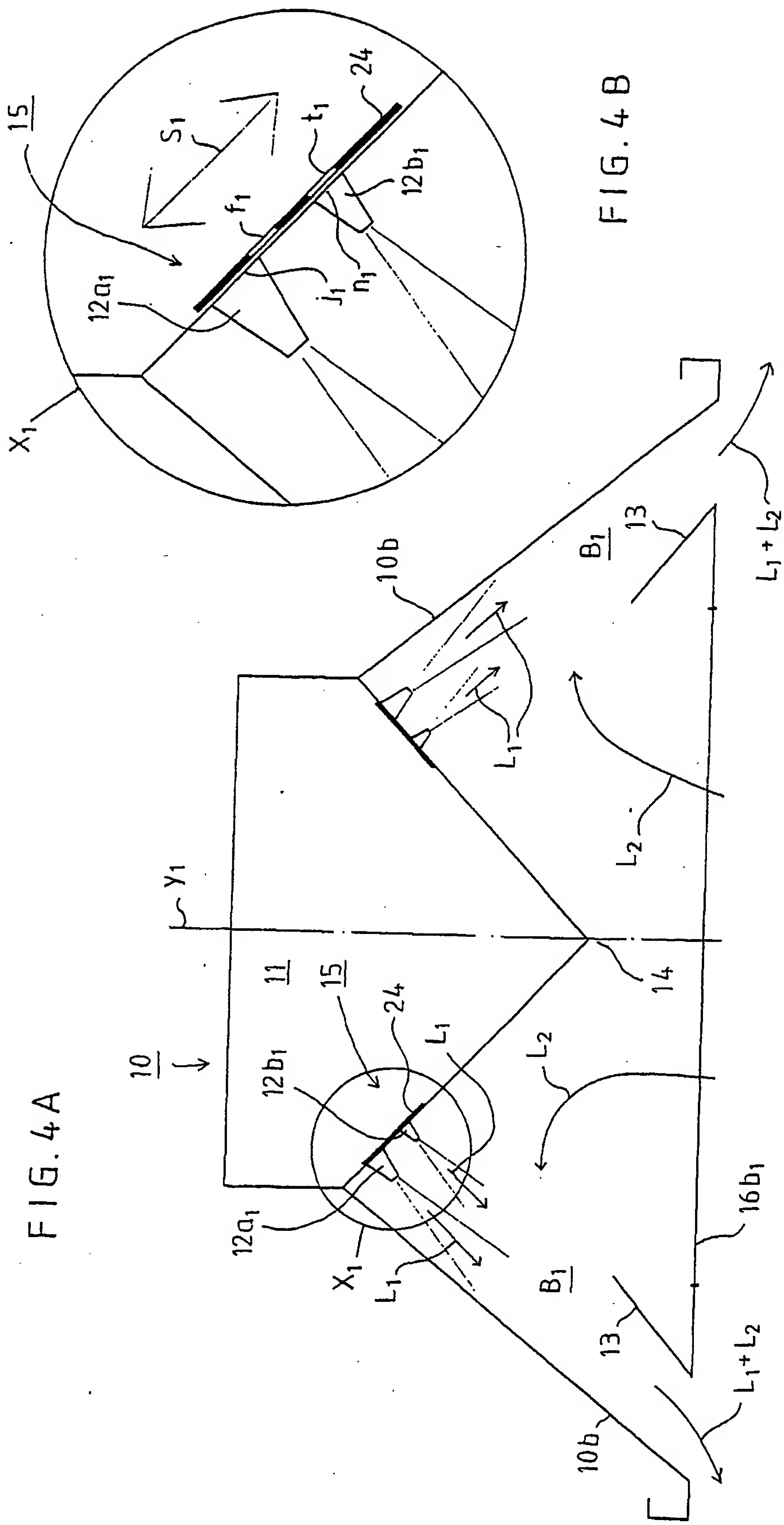

15
S_1
24
t_1
f_1
$12b_1$
$12a_1$
j_1
n_1
X_1
10b
B_1
13
L_1+L_2
L_1
L_2
Y_1
14
10
11
$16b_1$

FIG. 4A

FIG. 4B

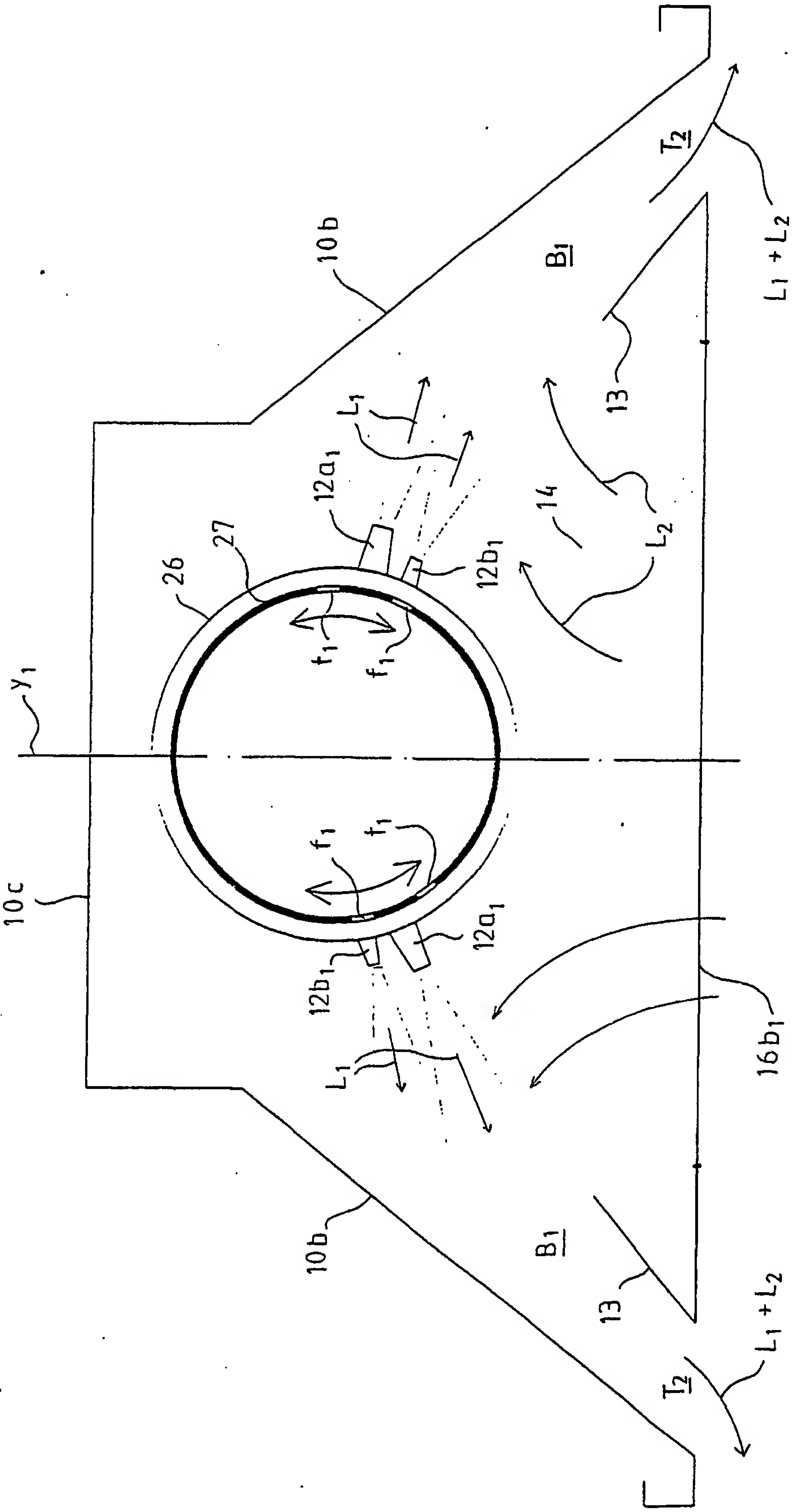


FIG.5

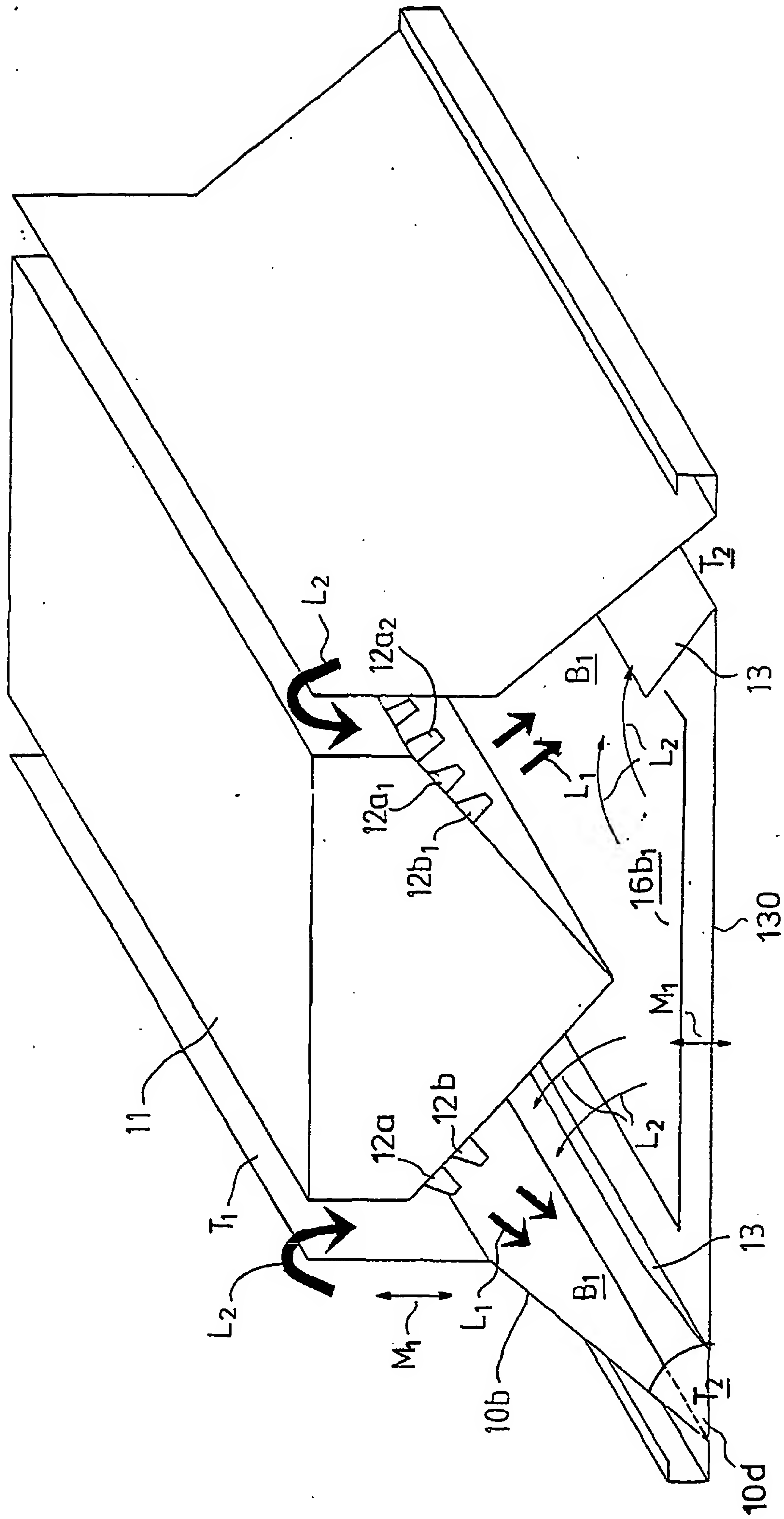

11
T1
L2
M1
L1
10b
B1
T2
10d
13
12a
12b
L2
M1
130
16b1
L1
L2
12b1
12a1
12a2
L2
B1
13
T2

FIG.6A

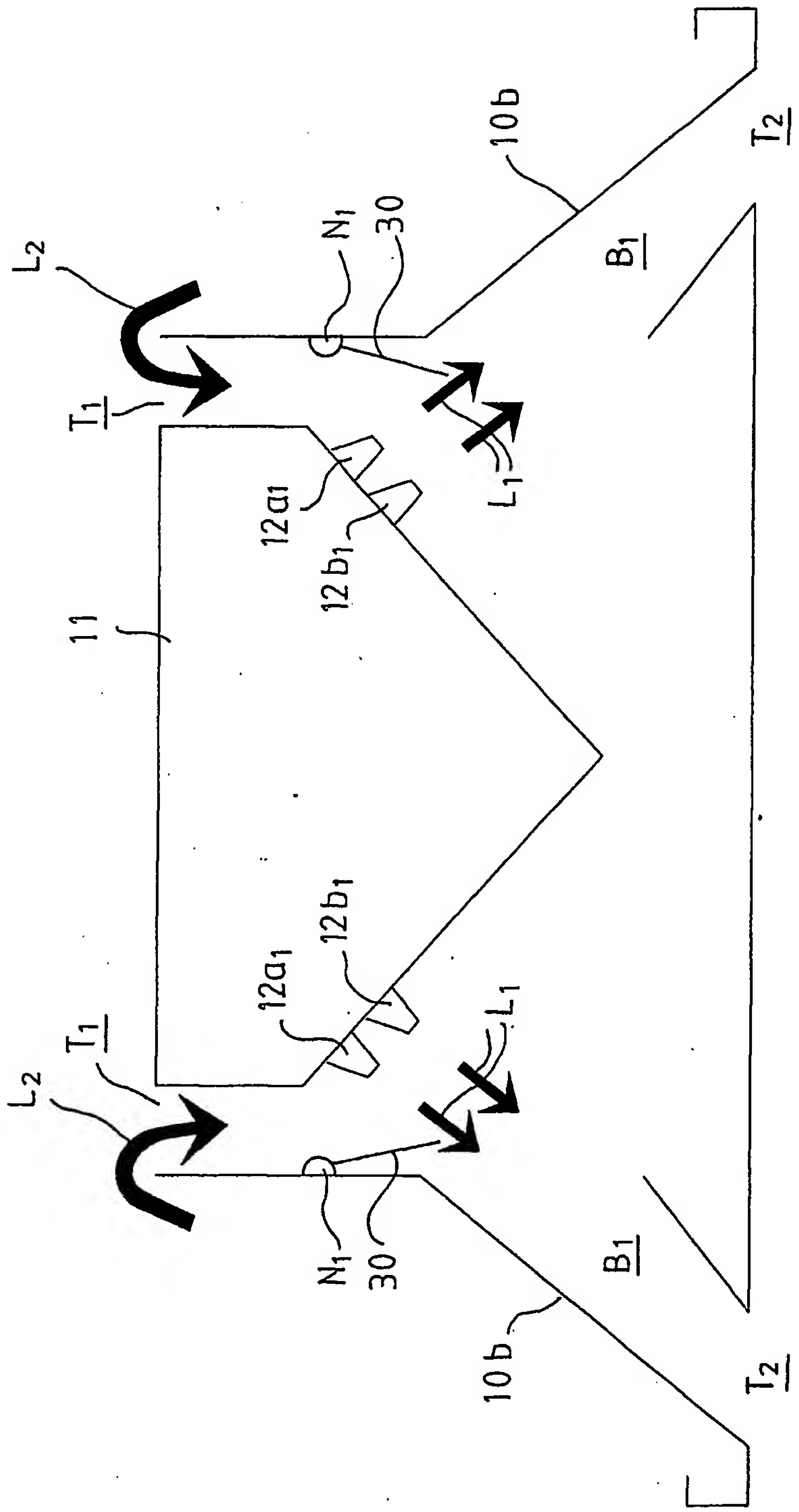

L2
T1
N1
30
10b
T2
B1
L1
12a1
12b1
11
12a1
12b1
L1
T1
L2
N1
30
B1
10b
T2

FIG.6B

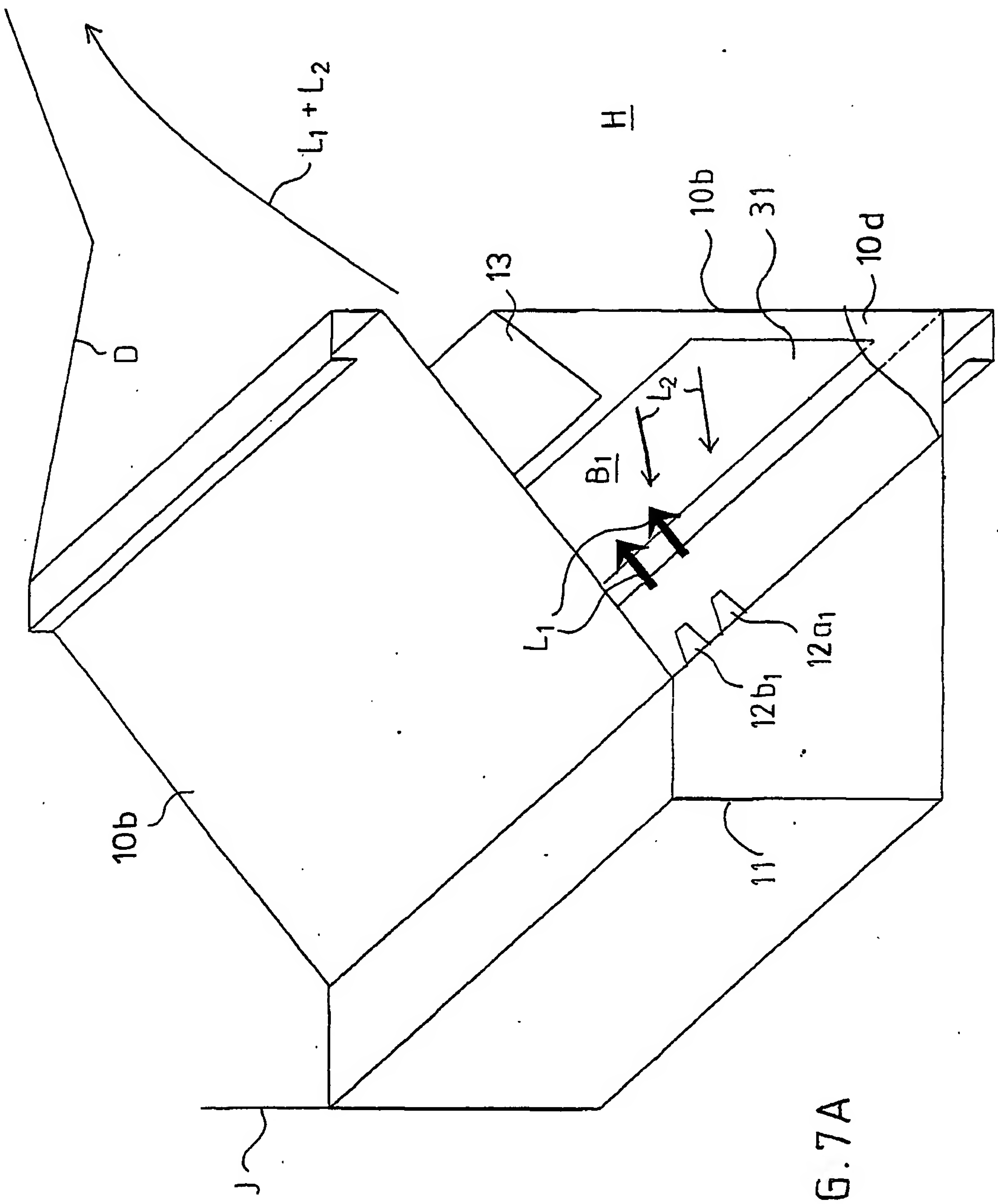


FIG. 7A

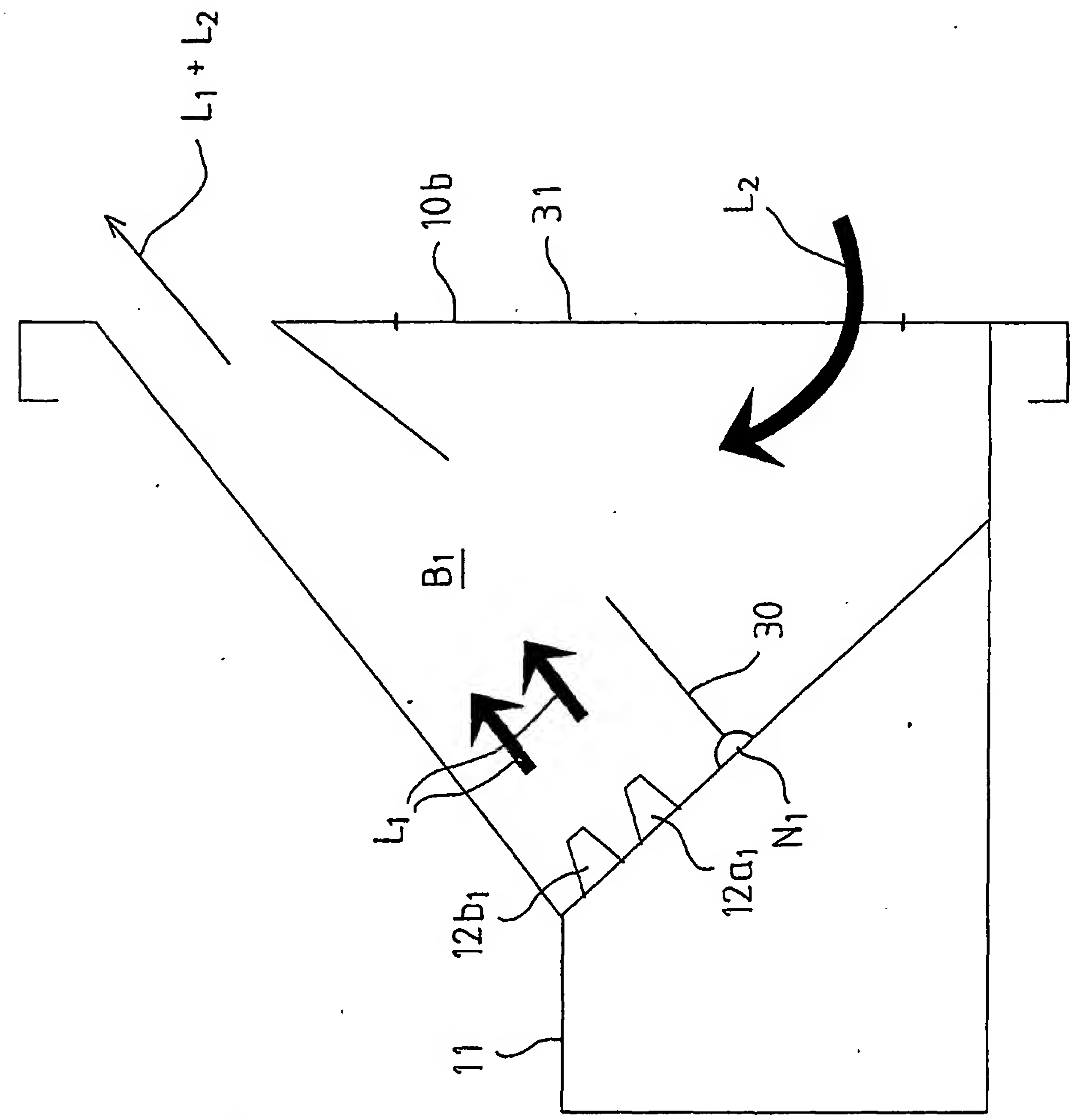
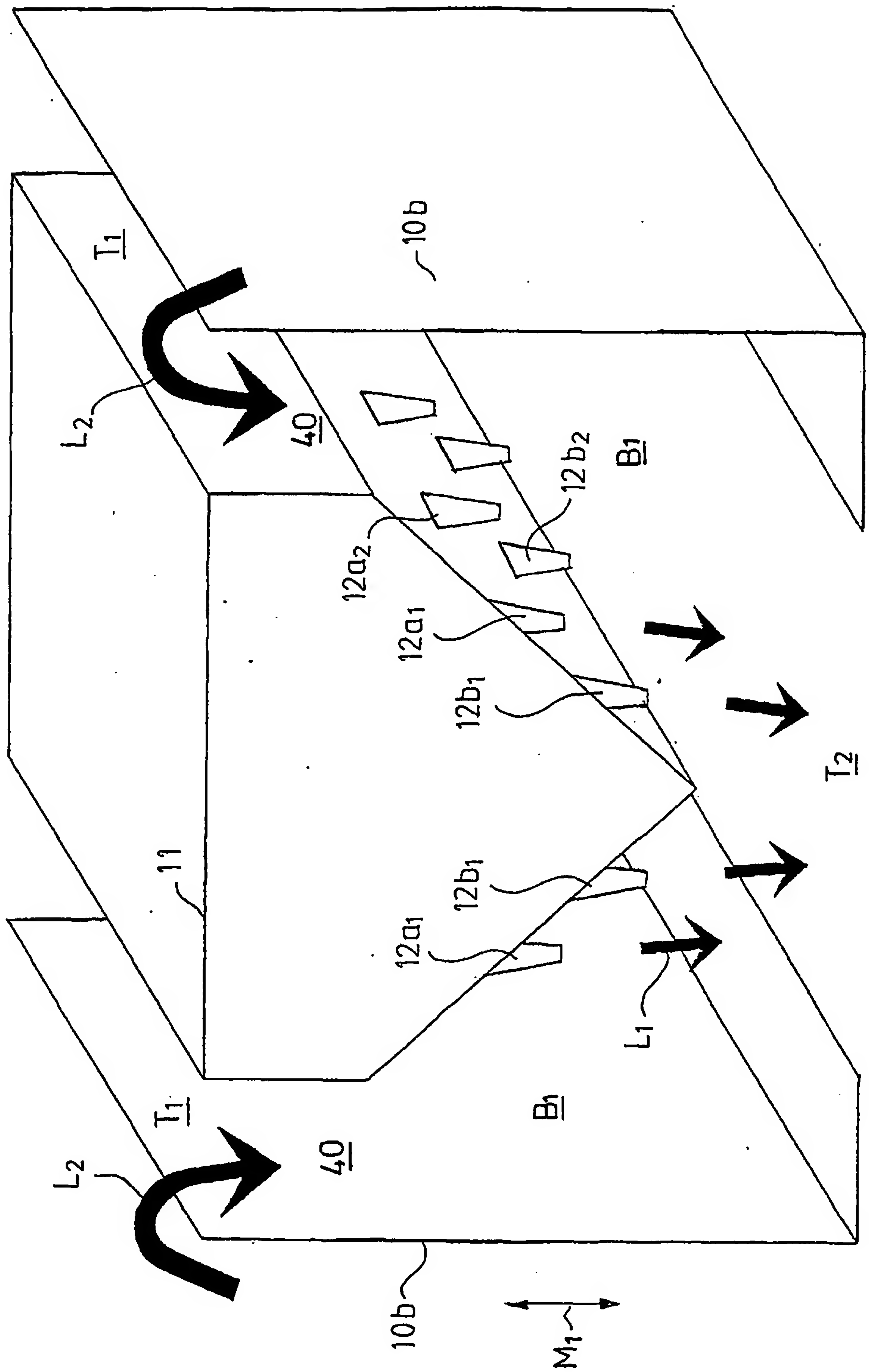


FIG.7B

FIG. 8A



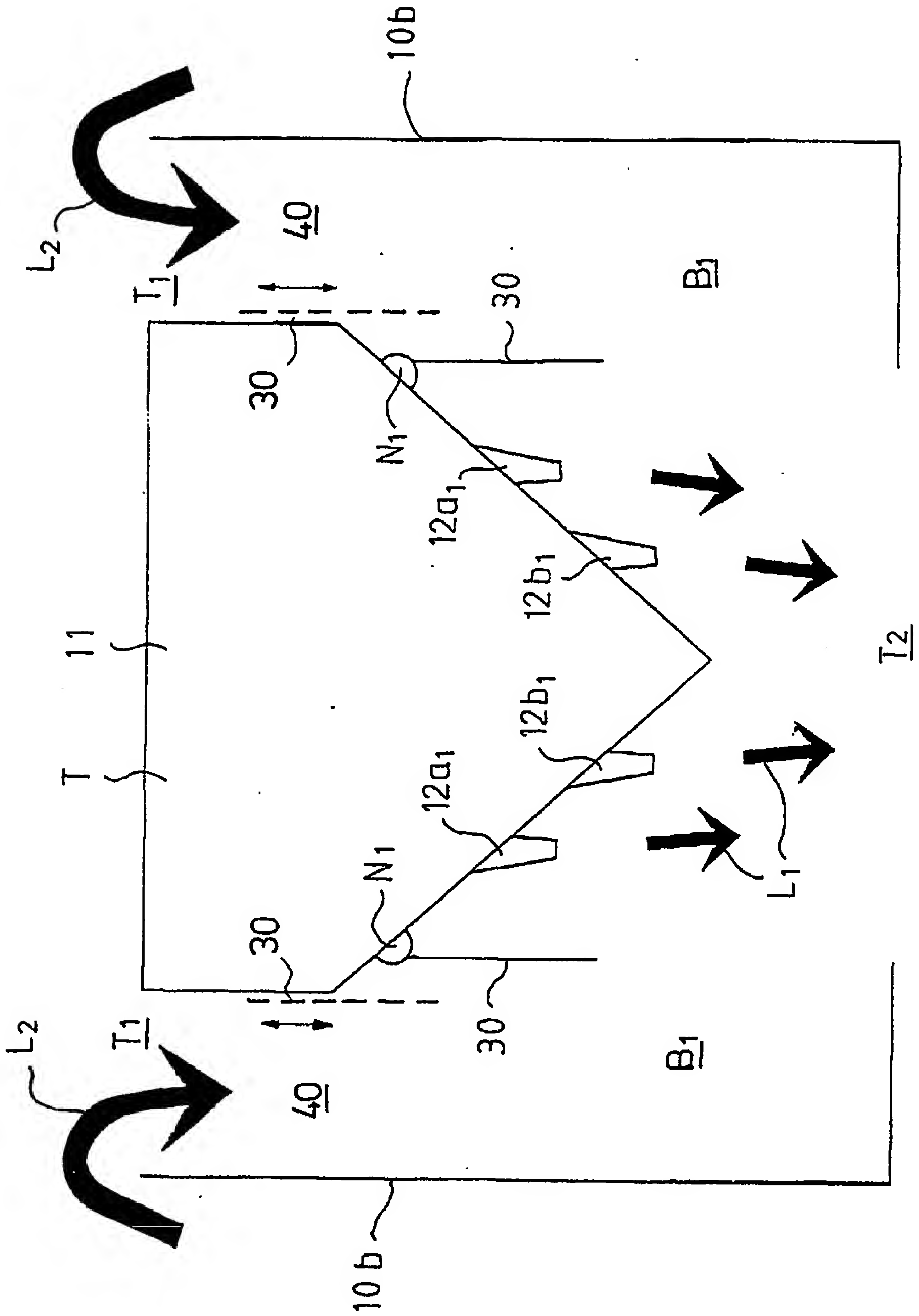


FIG. 8B

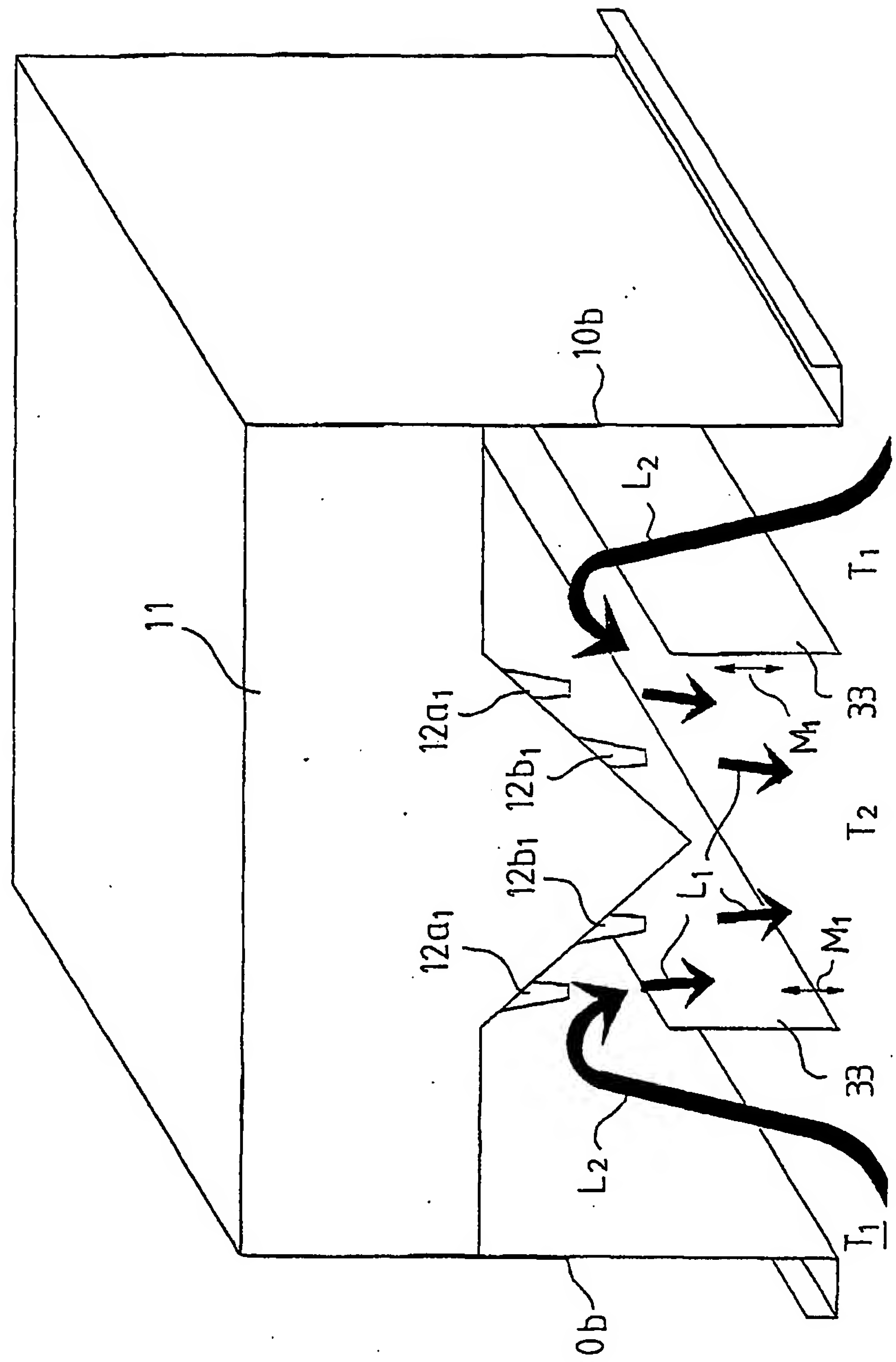


FIG.9A

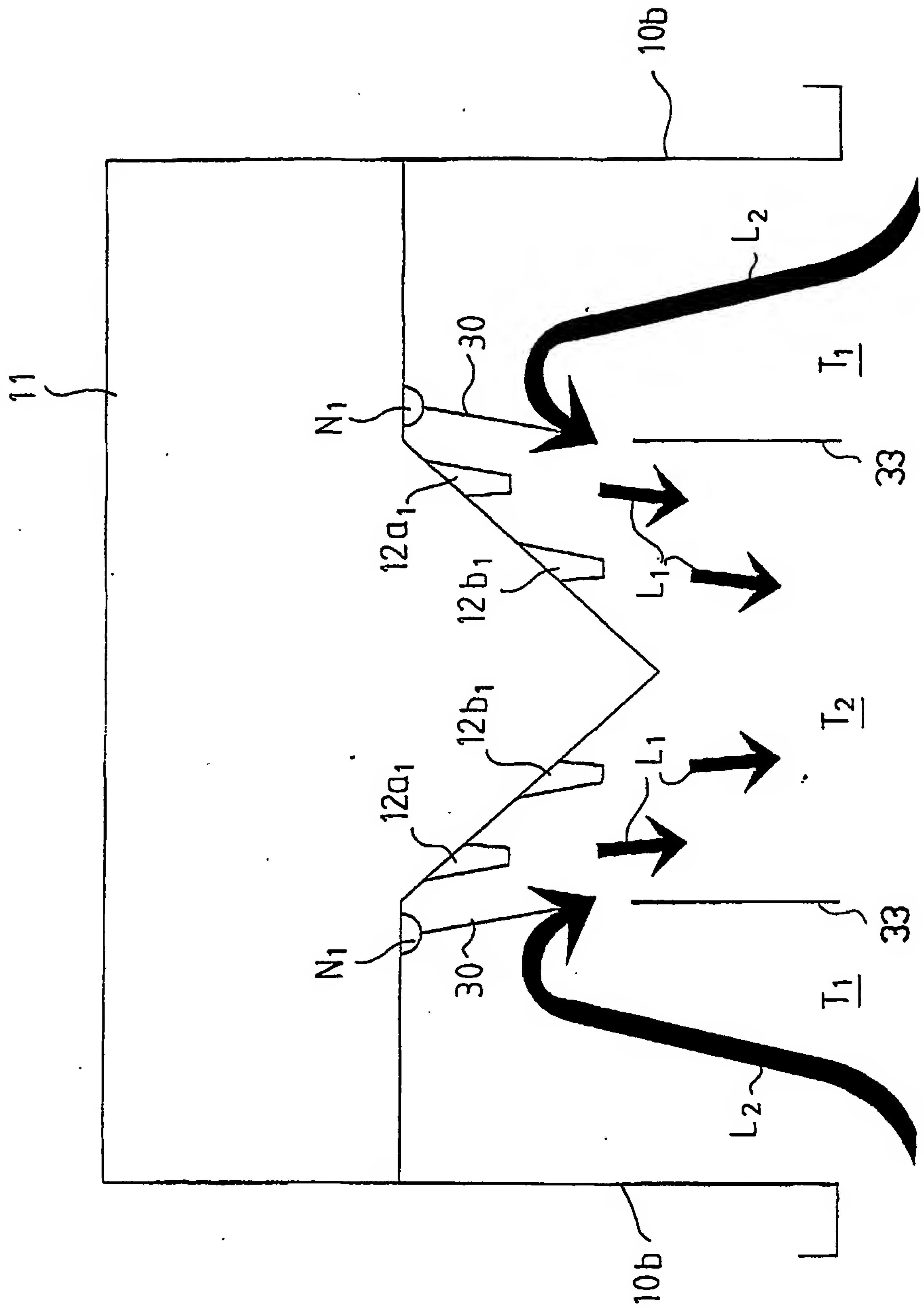

11
10b
10b
L2
L2
30
30
N1
N1
12a1
12a1
12b1
12b1
L1
L1
T1
T1
T2
33
33

FIG.9B

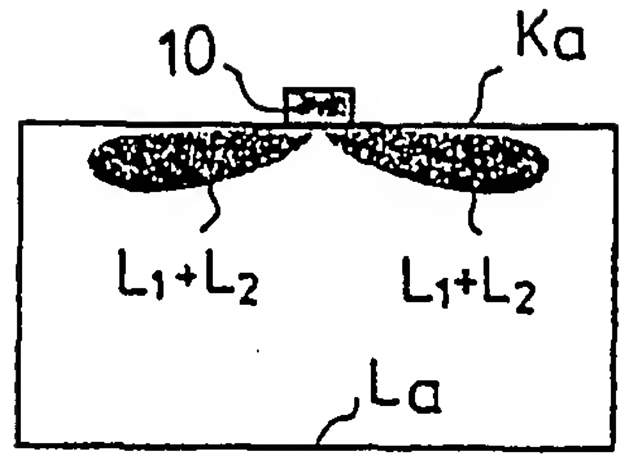


FIG. 10A

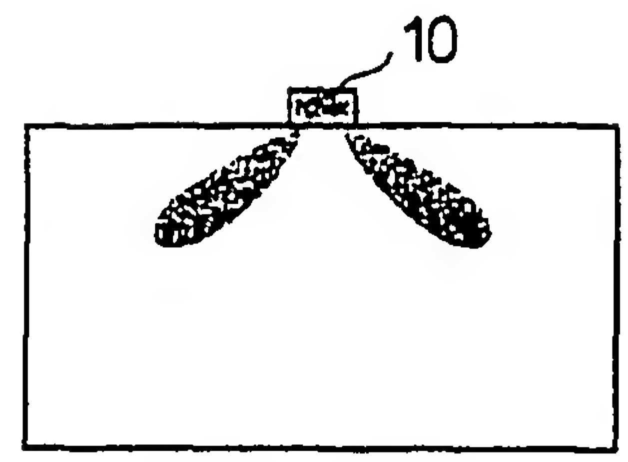


FIG. 10B

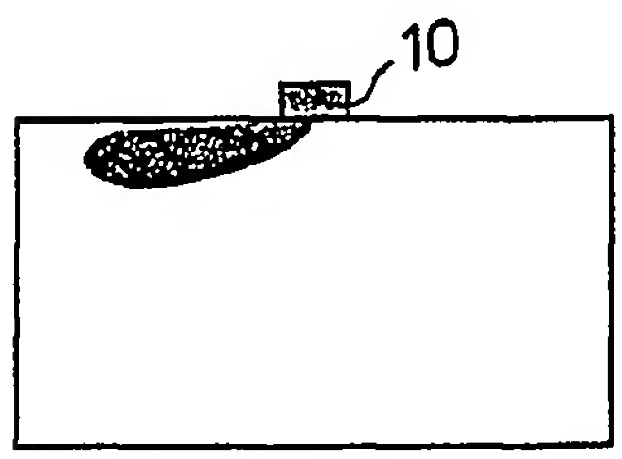


FIG. 10C

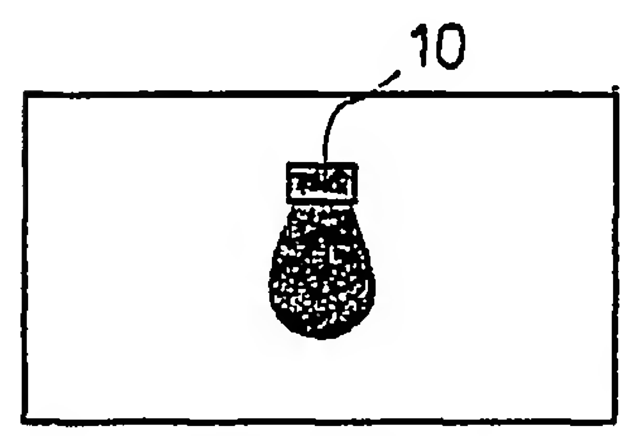


FIG. 10D

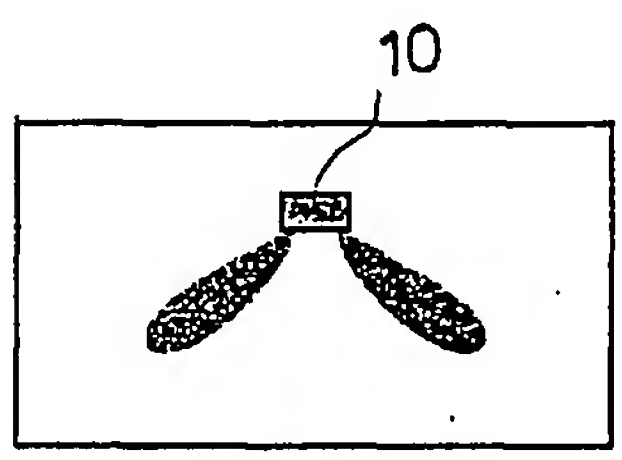


FIG. 10E

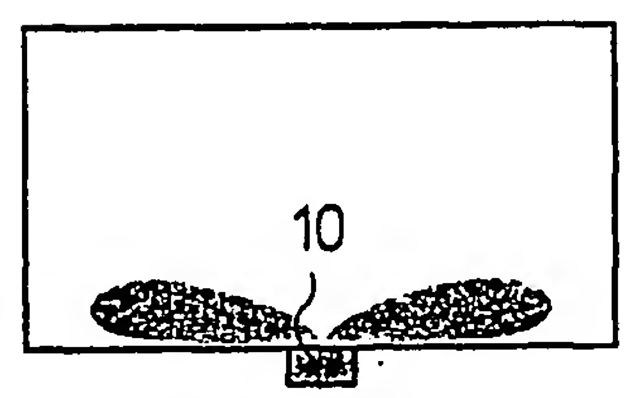


FIG. 10F

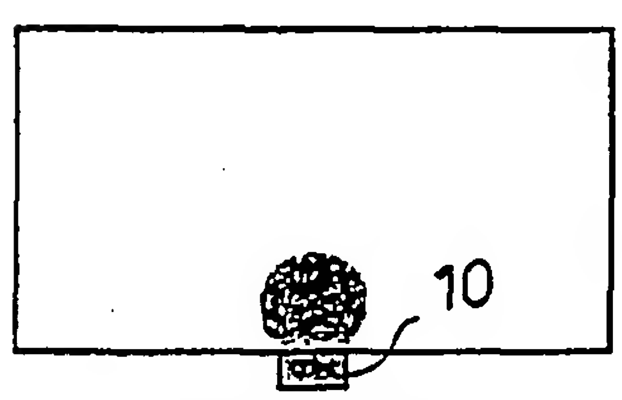


FIG. 10G

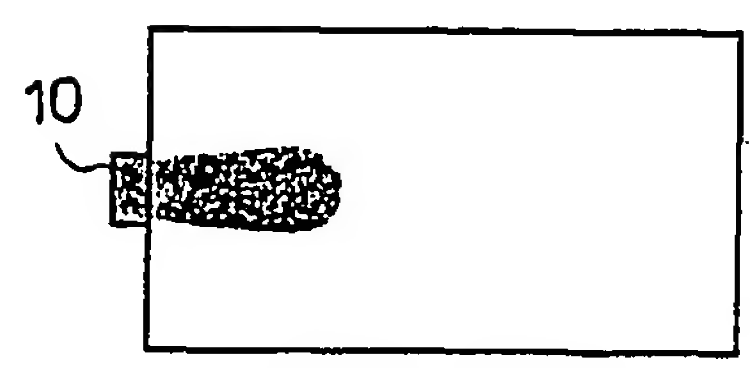


FIG. 10H

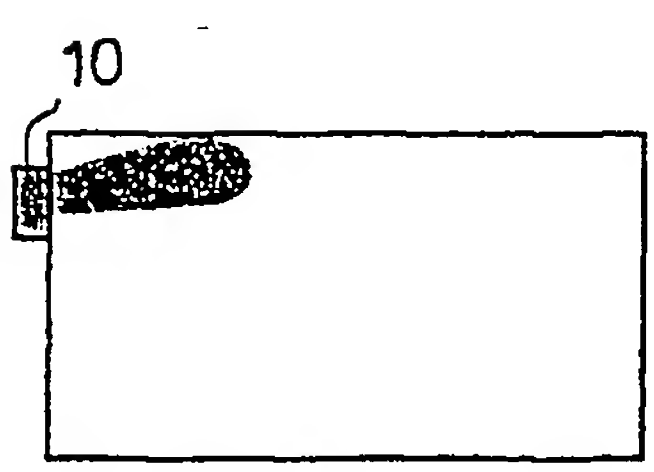


FIG. 10I

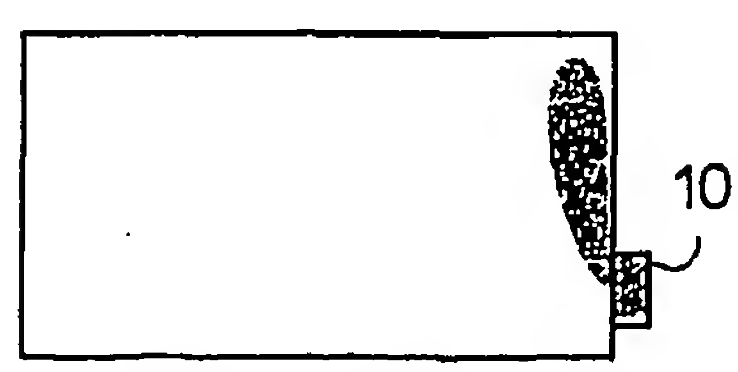


FIG. 10J

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/01006

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F24F 1/01, F24F 13/26 // F24F 13/072
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0045094 A1 (STIFAB FAREX AB), 3 August 2000 (03.08.00), figures 1-8, abstract --	1-3,6,8
X	GB 2349688 A (HALTON OY), 8 November 2000 (08.11.00), figure 1, abstract	1-2,13
Y	 --	14-16
Y	FI 58211 B (FINCOIL-TEOLLISUUS OY), 29 August 1980 (29.08.80), figure 1, claims --	14-16
X	GB 2271175 A (HALTON OY), 6 April 1994 (06.04.94), figures 1-3, abstract --	1-3,8

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 February 2002	25 -02- 2002

Name and mailing address of the ISA/	Authorized officer
Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Anna R-Salomonsson / MRo Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/01006

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1122501 A1 (STIFAB FAREX AB), 8 August 2001 (08.08.01), figures 1-4, abstract --	1-3,13
P,A	FR 2807501 A1 (HALTON OY), 12 October 2001 (12.10.01), figures 1-7, abstract -- --------	1-24

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI 01/01006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0045094 A1	03/08/00	AU 2470100 A	18/08/00
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